

FIG. 1

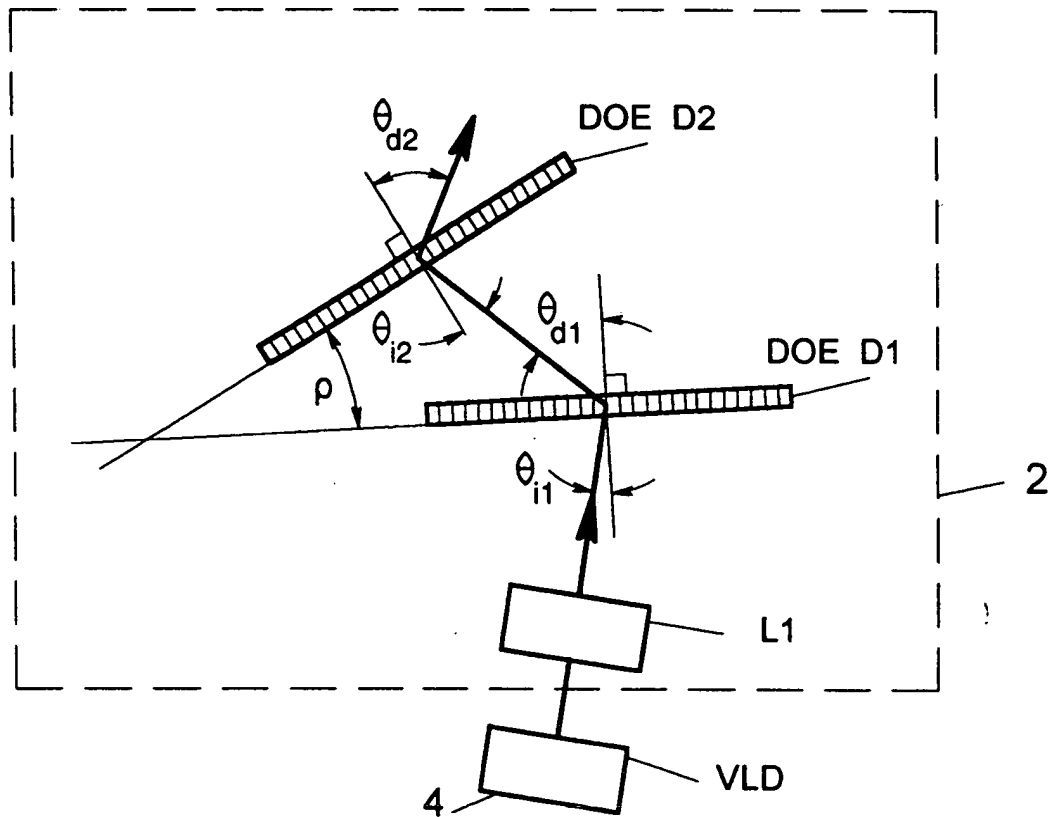


FIG. 1A

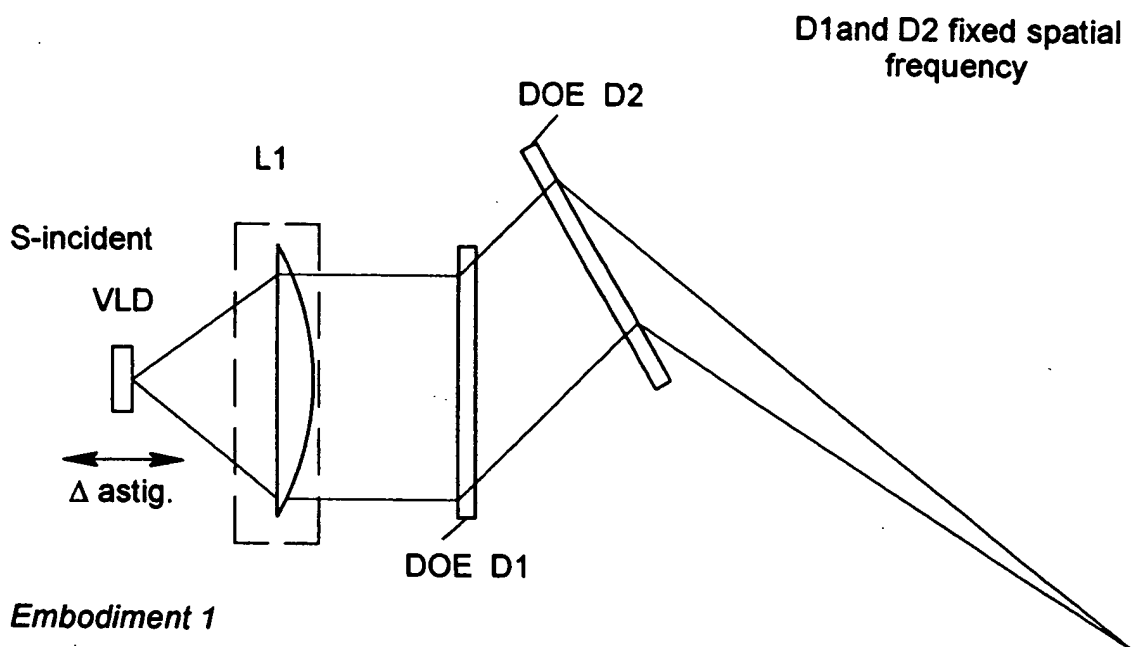
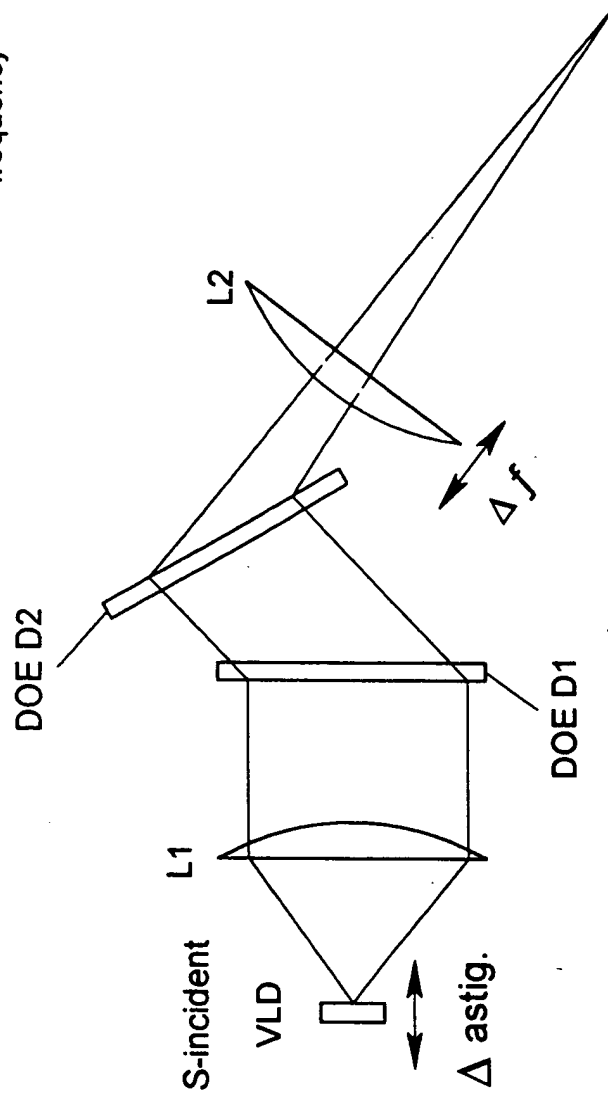


FIG. 2A

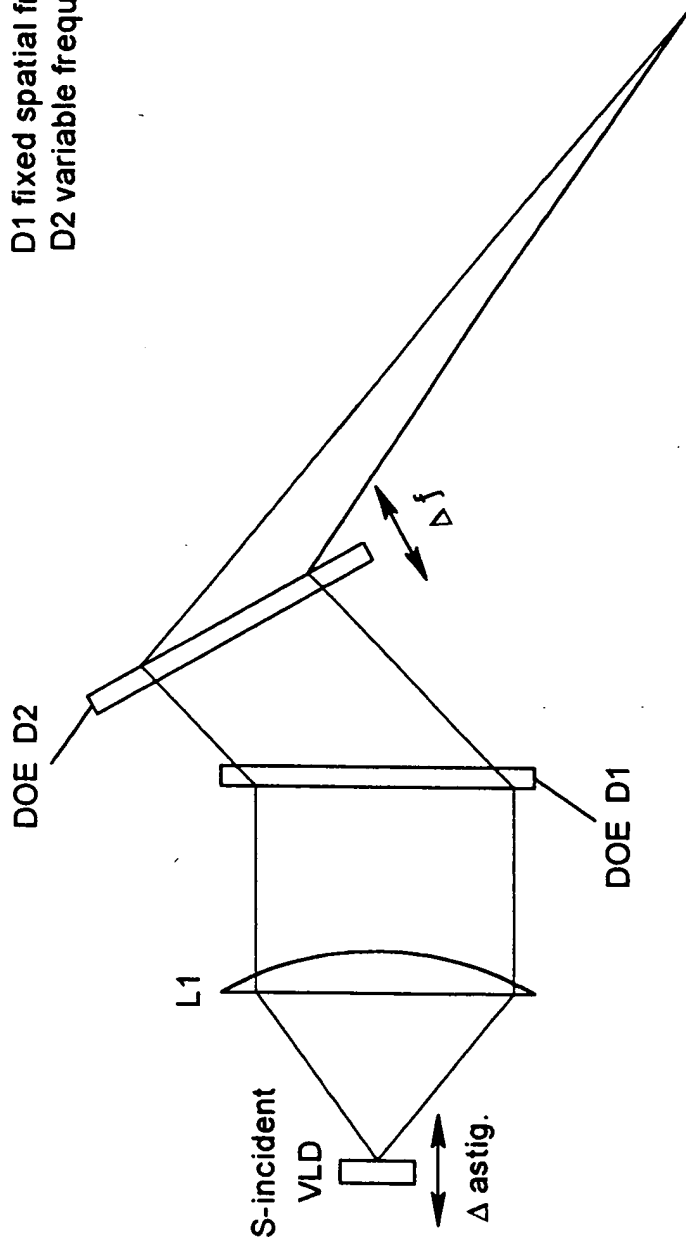
D1 and D2 fixed spatial frequency



Embodiment 2

FIG. 2B

D1 fixed spatial frequency
D2 variable frequency



Embodiment 3

FIG. 2C

FIG. 2D

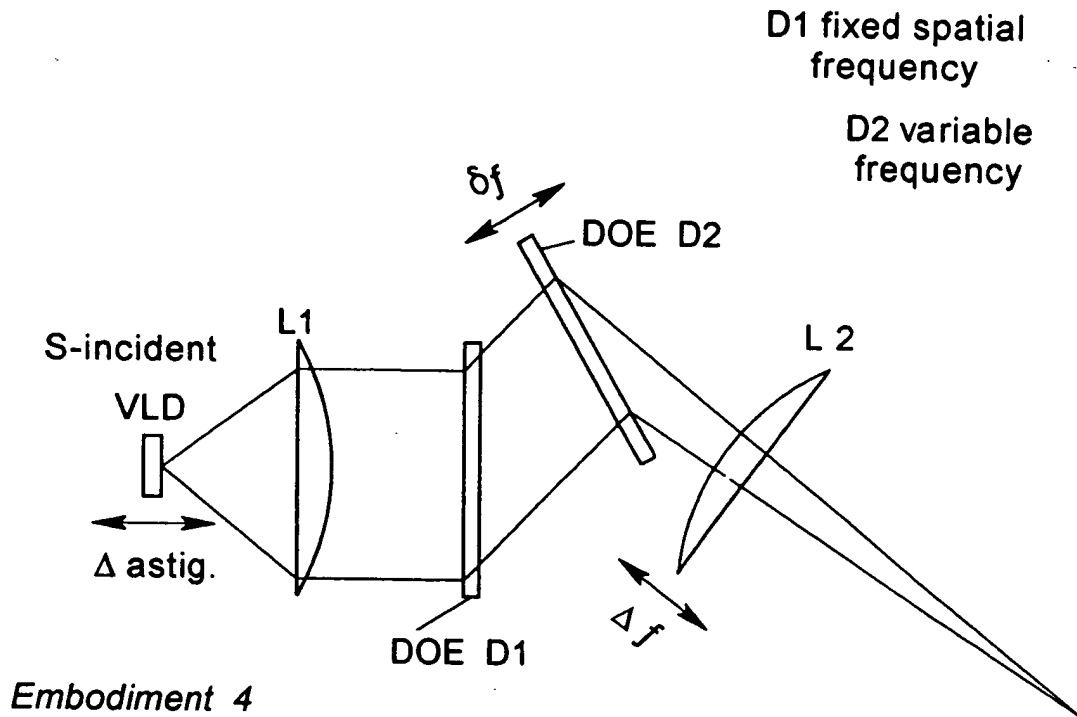


FIG. 2D

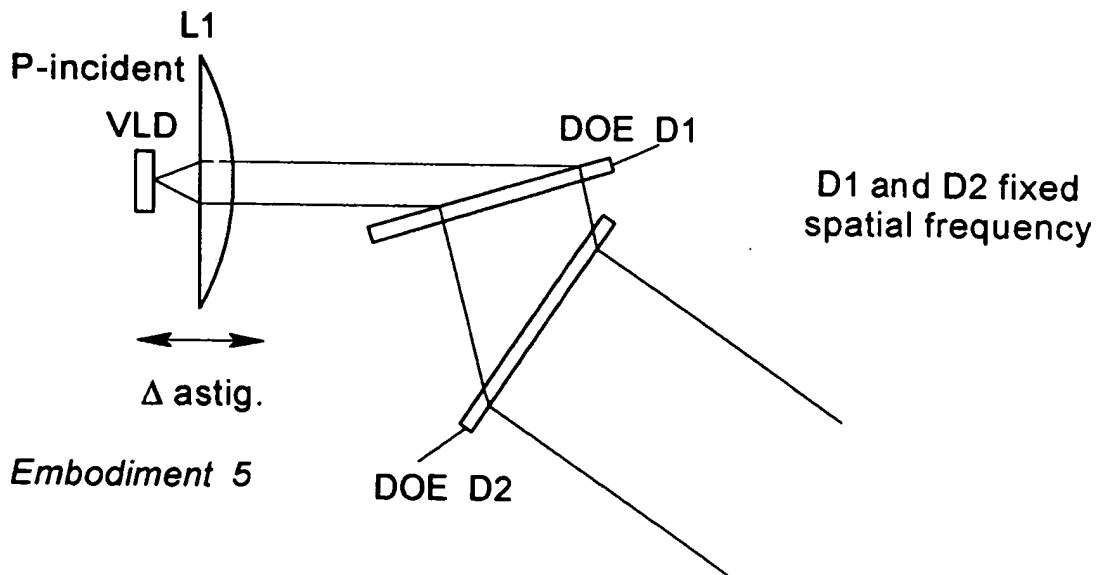


FIG. 2E

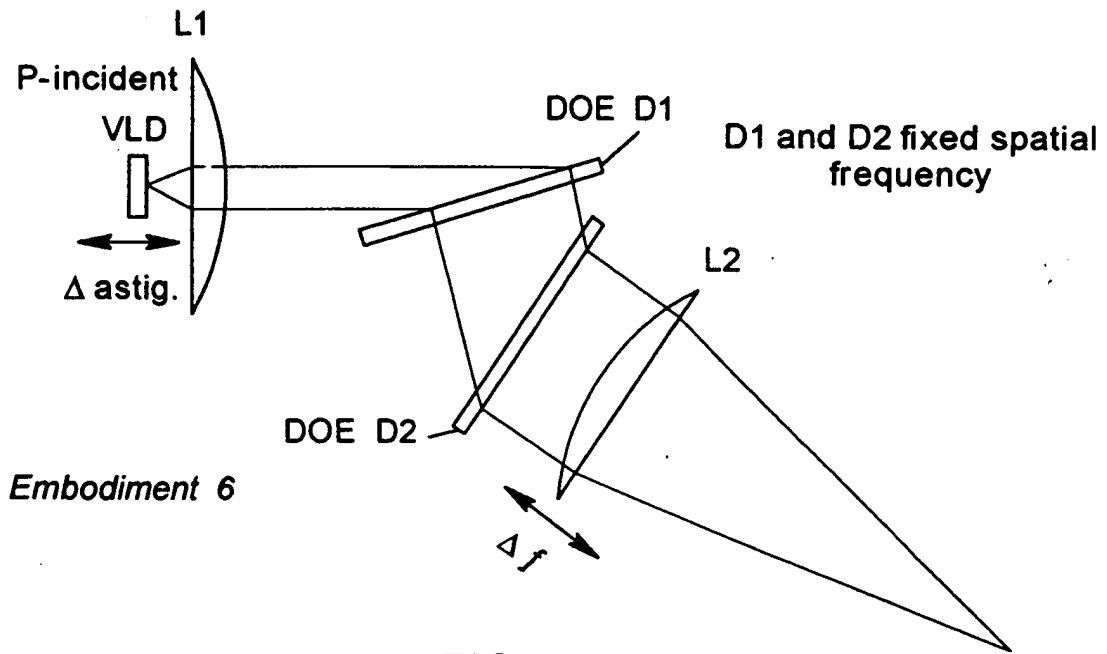


FIG. 2F

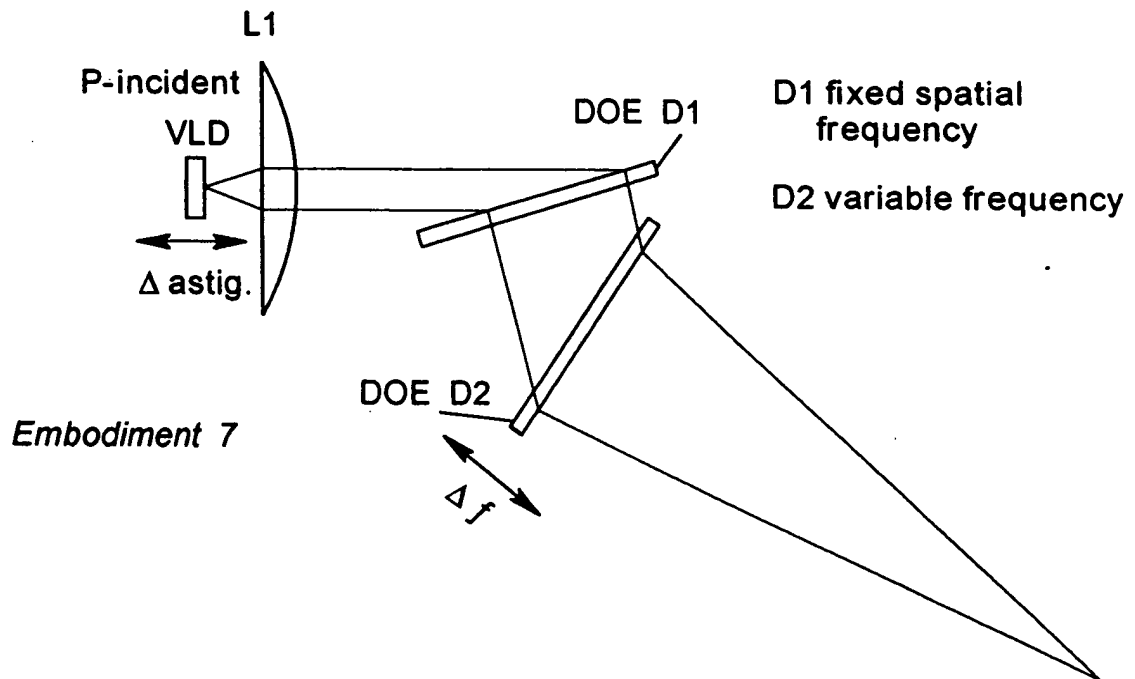
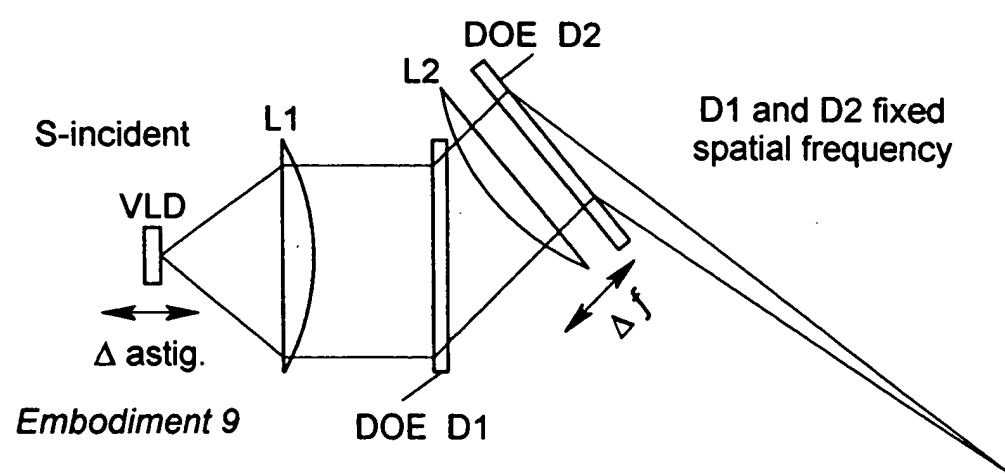
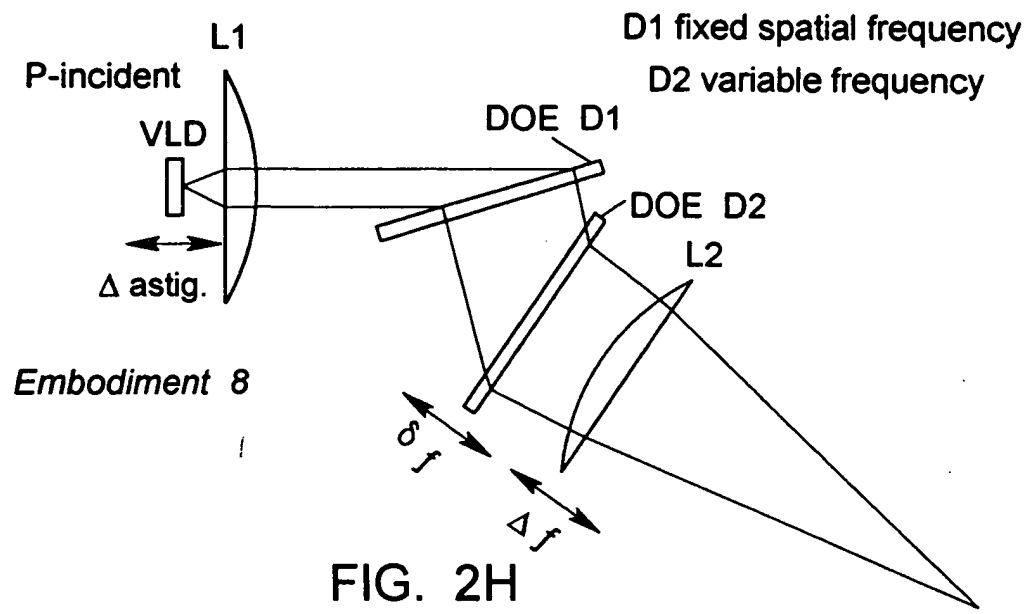
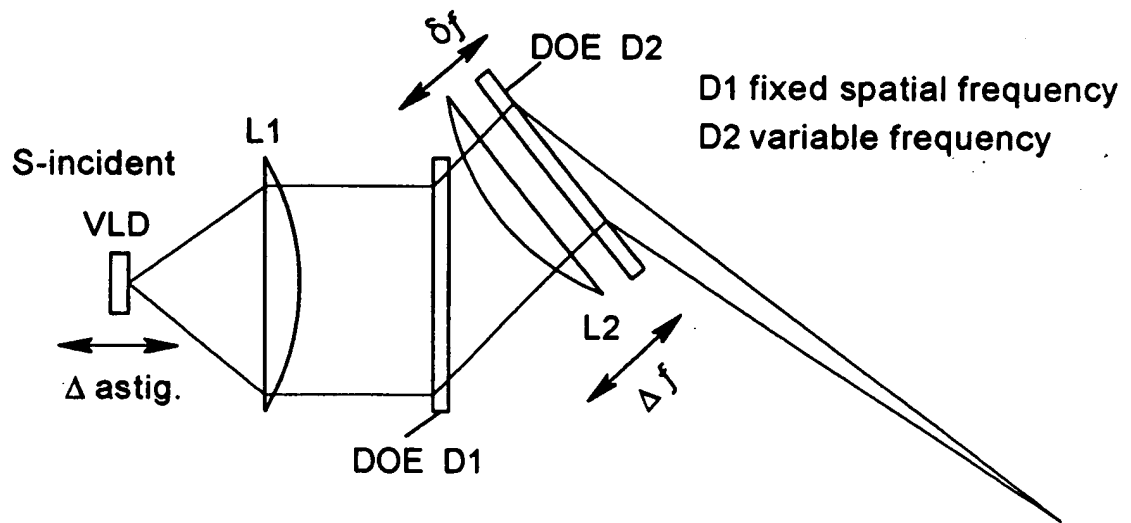


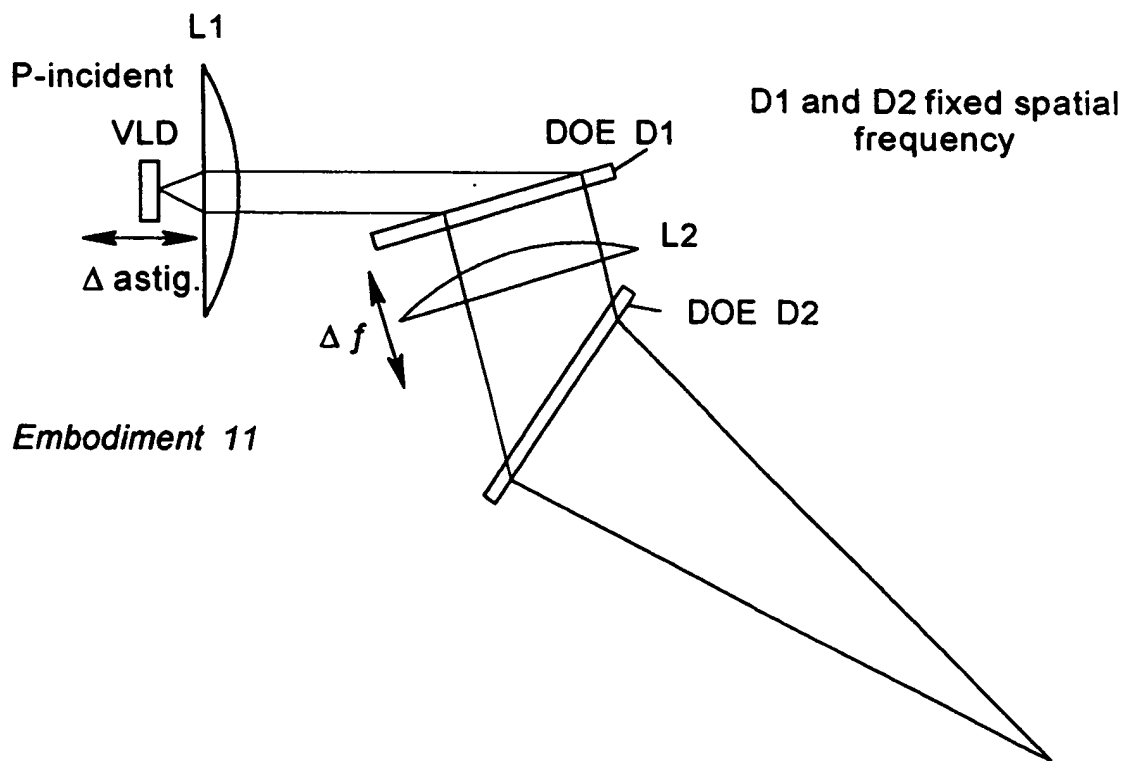
FIG. 2G





Embodiment 10

FIG. 2J



Embodiment 11

FIG. 2K

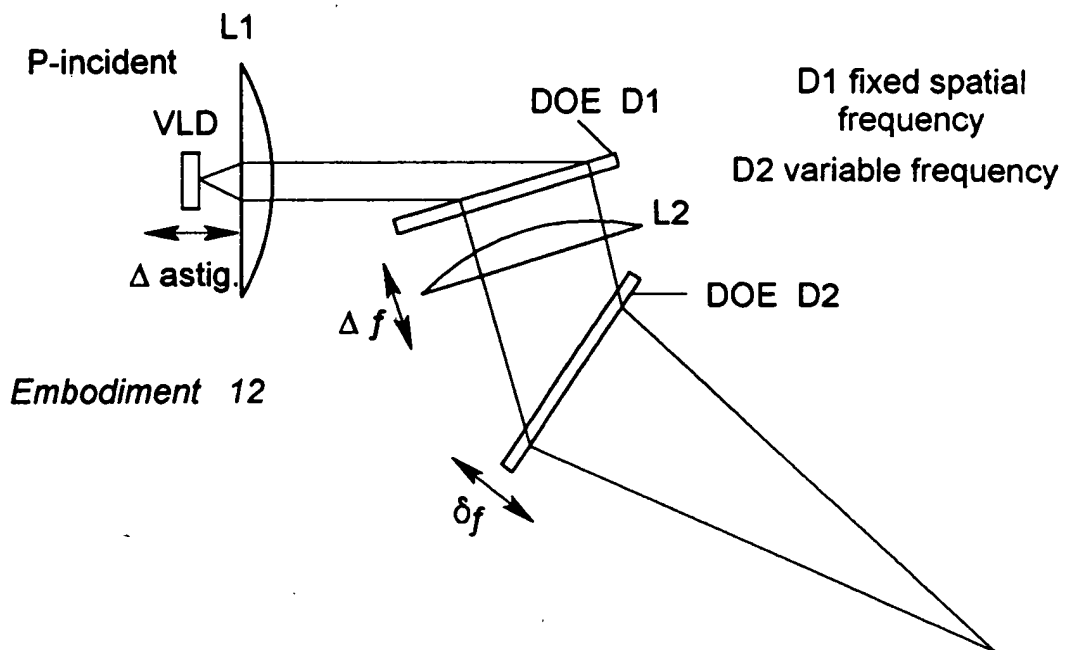


FIG. 2L

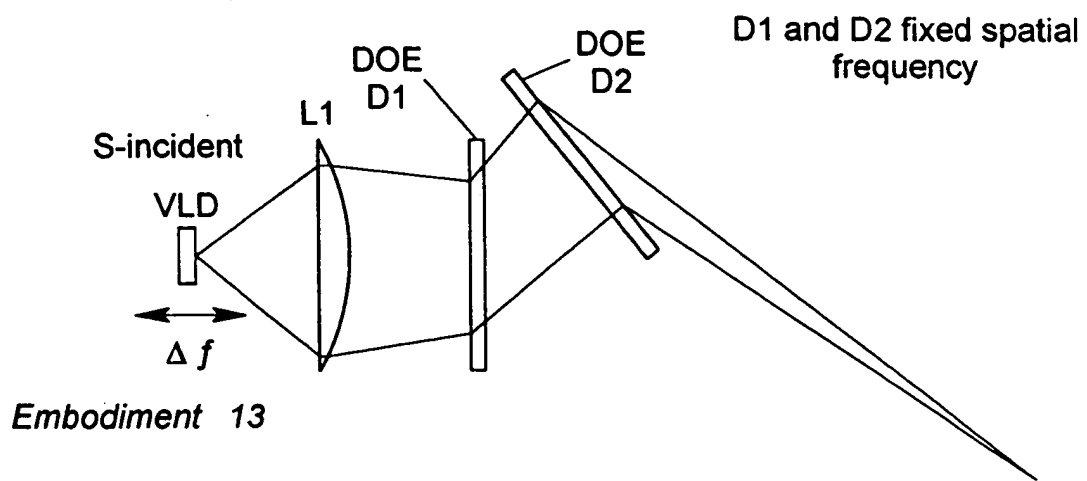


FIG. 2M

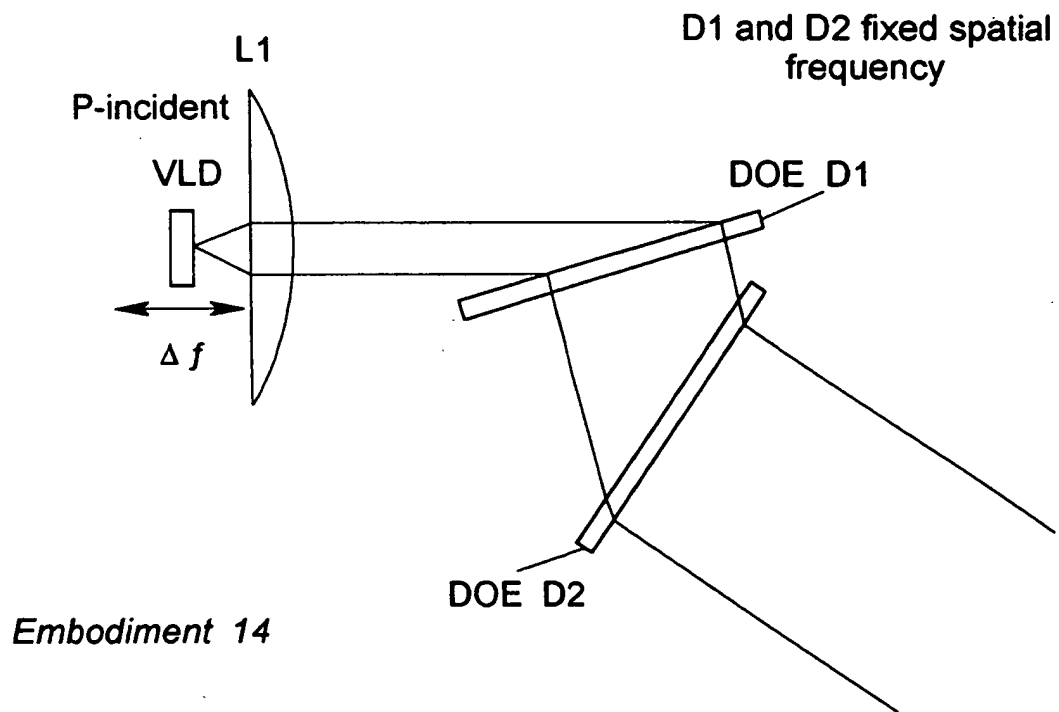


FIG. 2N

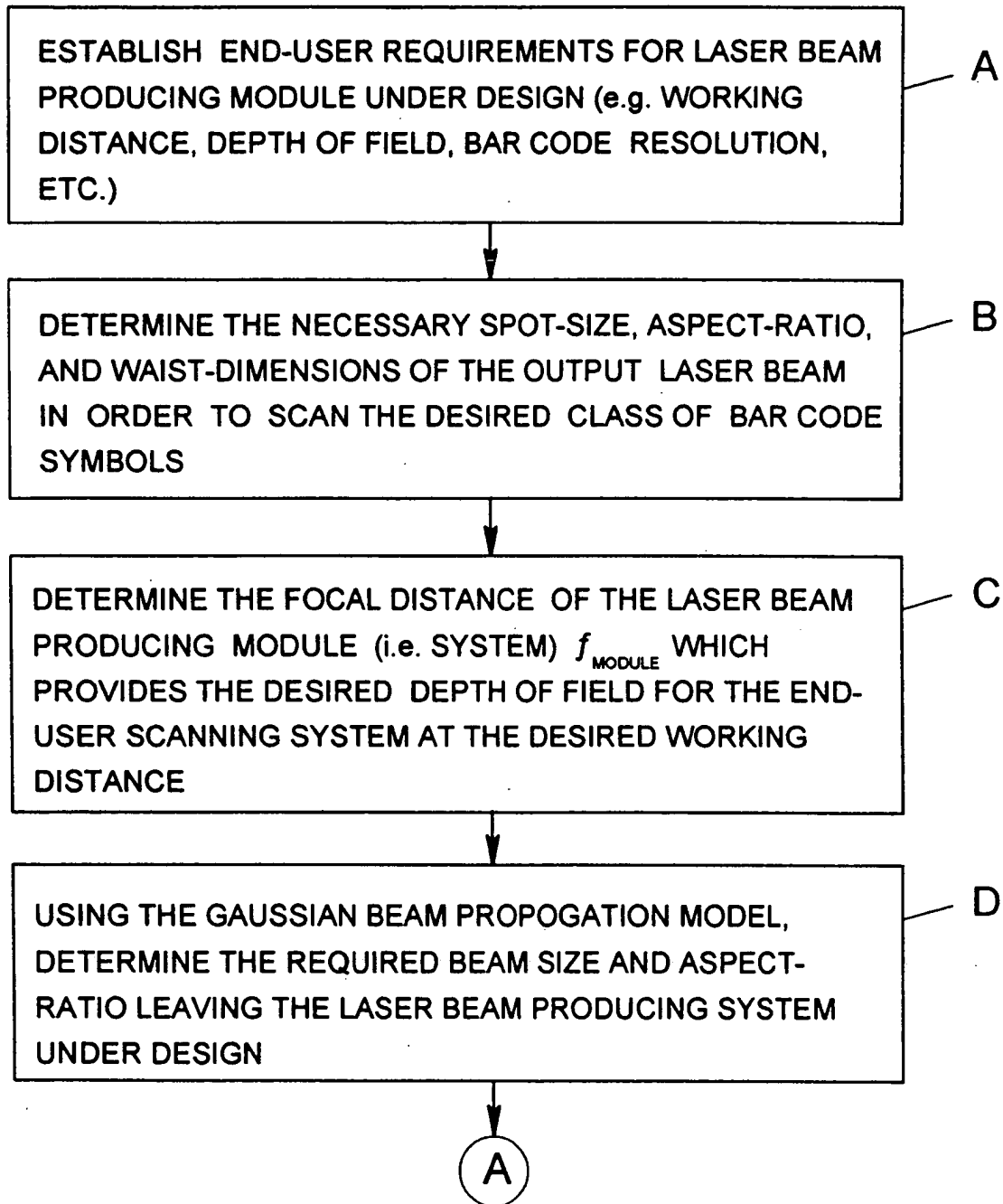


FIG. 3A1

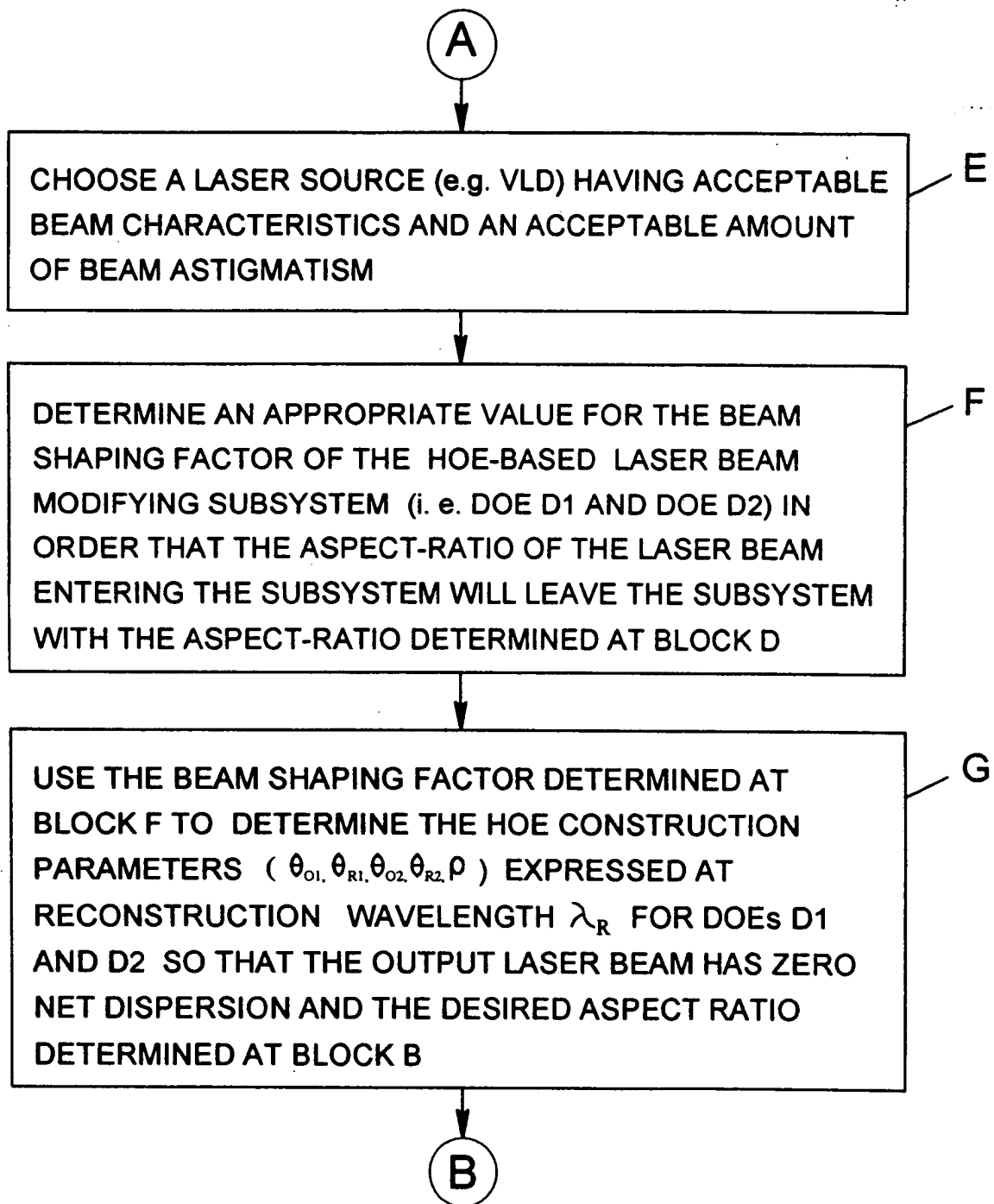


FIG. 3A2

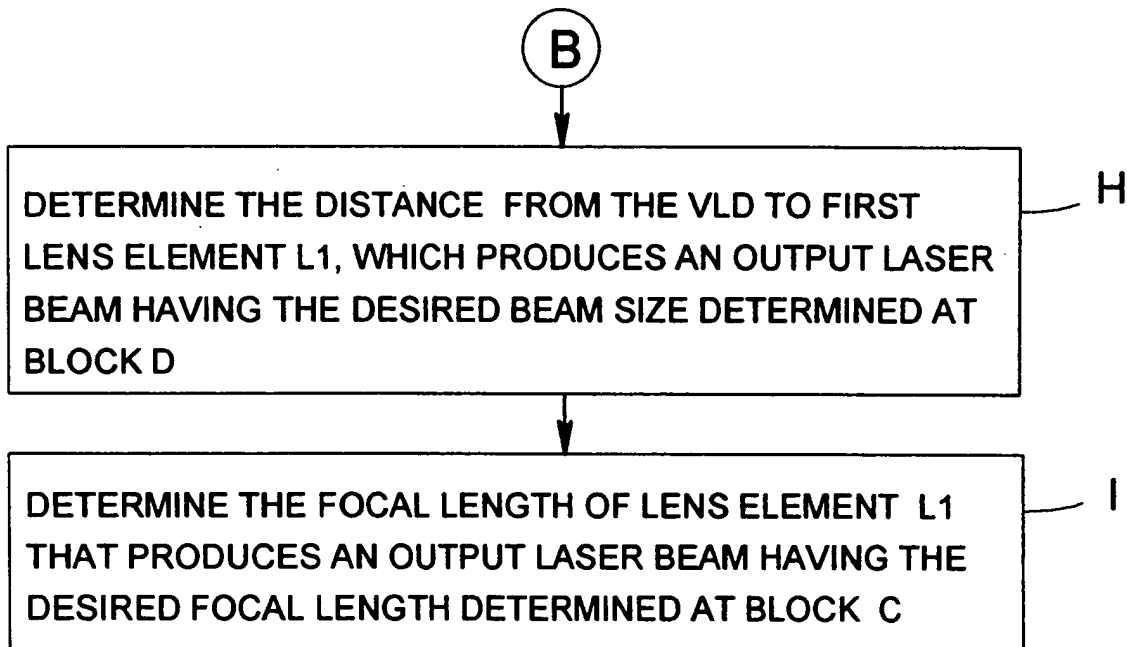


FIG. 3A3

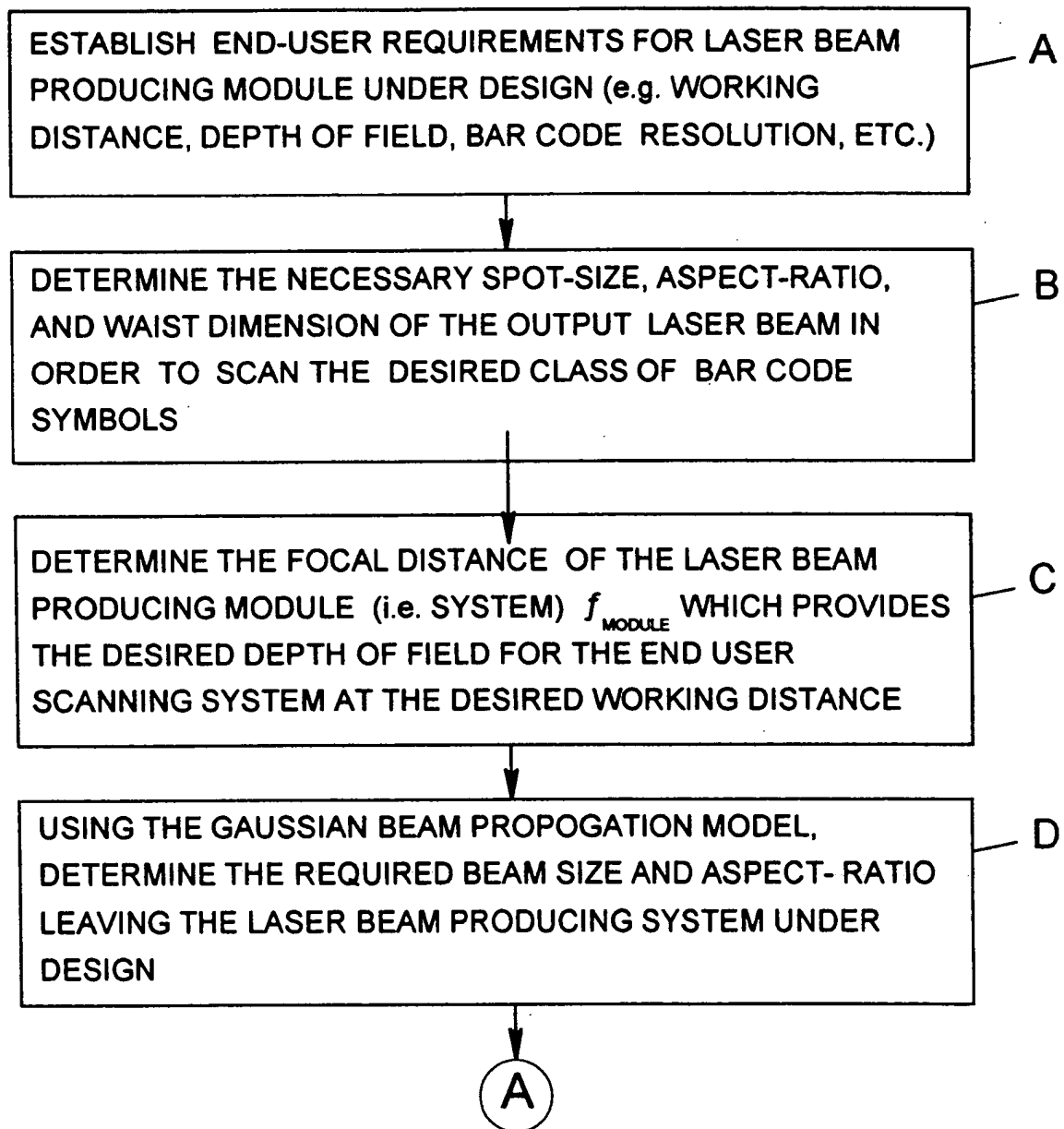


FIG. 3B1

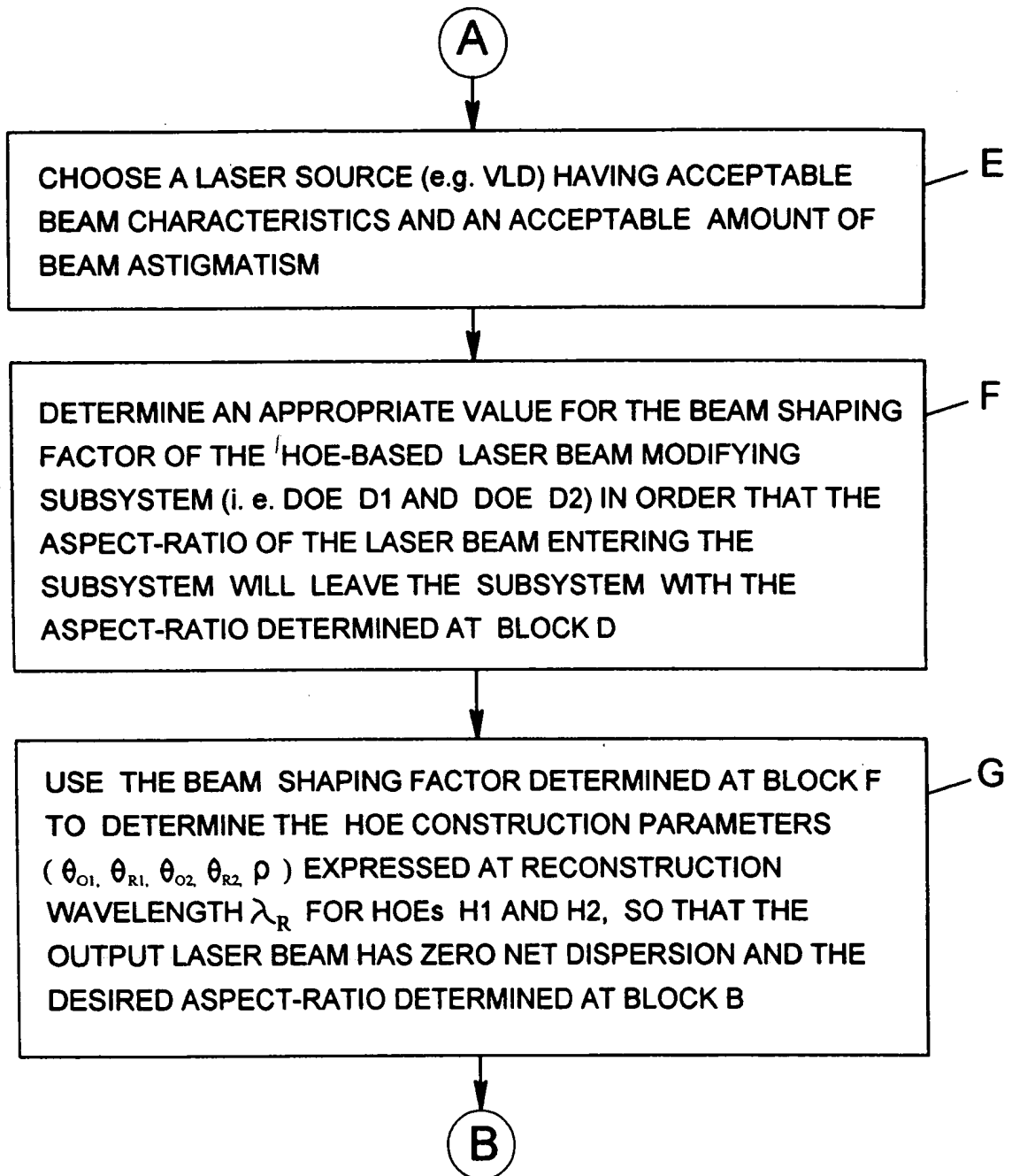


FIG. 3B2

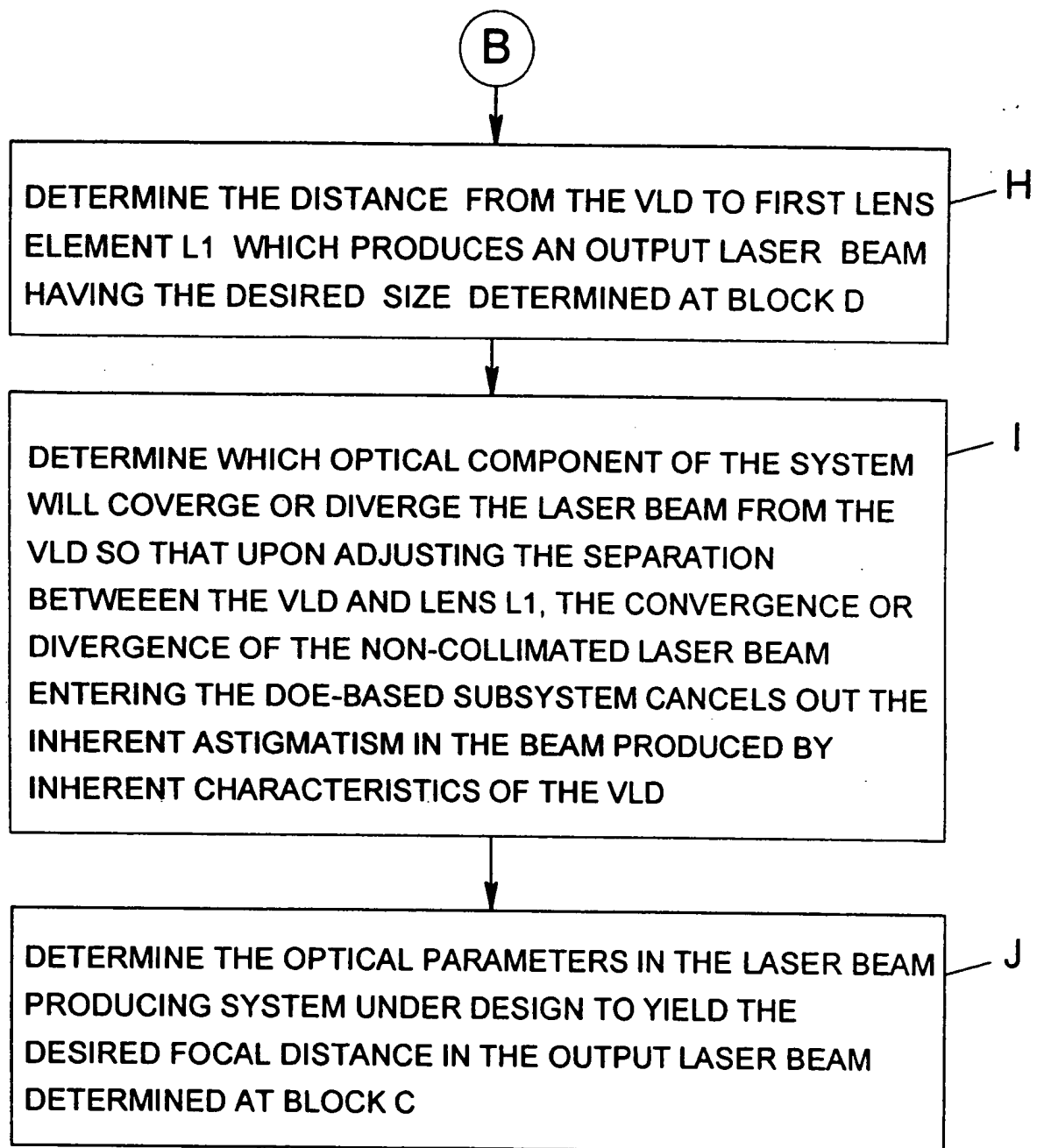


FIG. 3B3

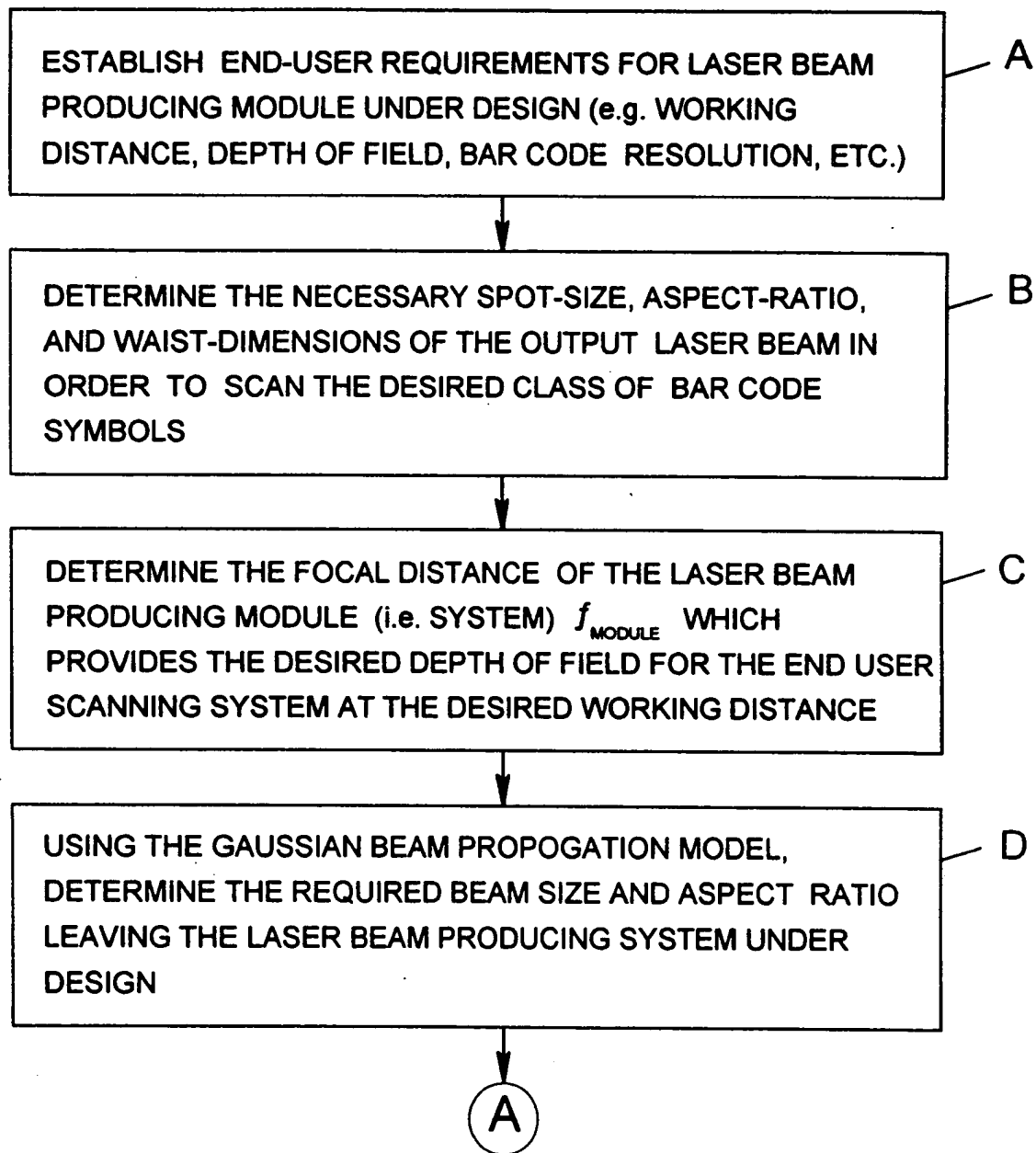


FIG. 3C1

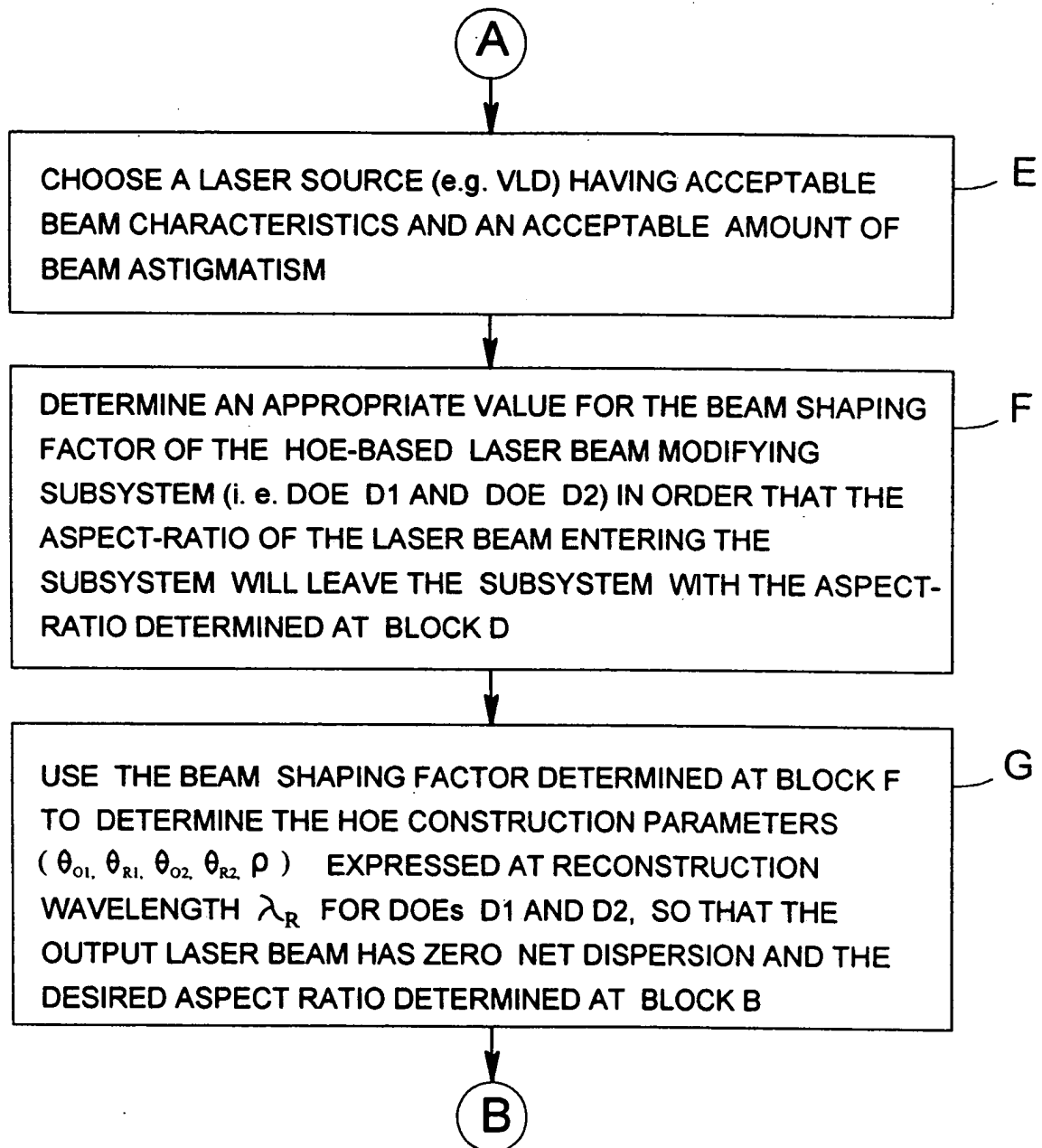


FIG. 3C2

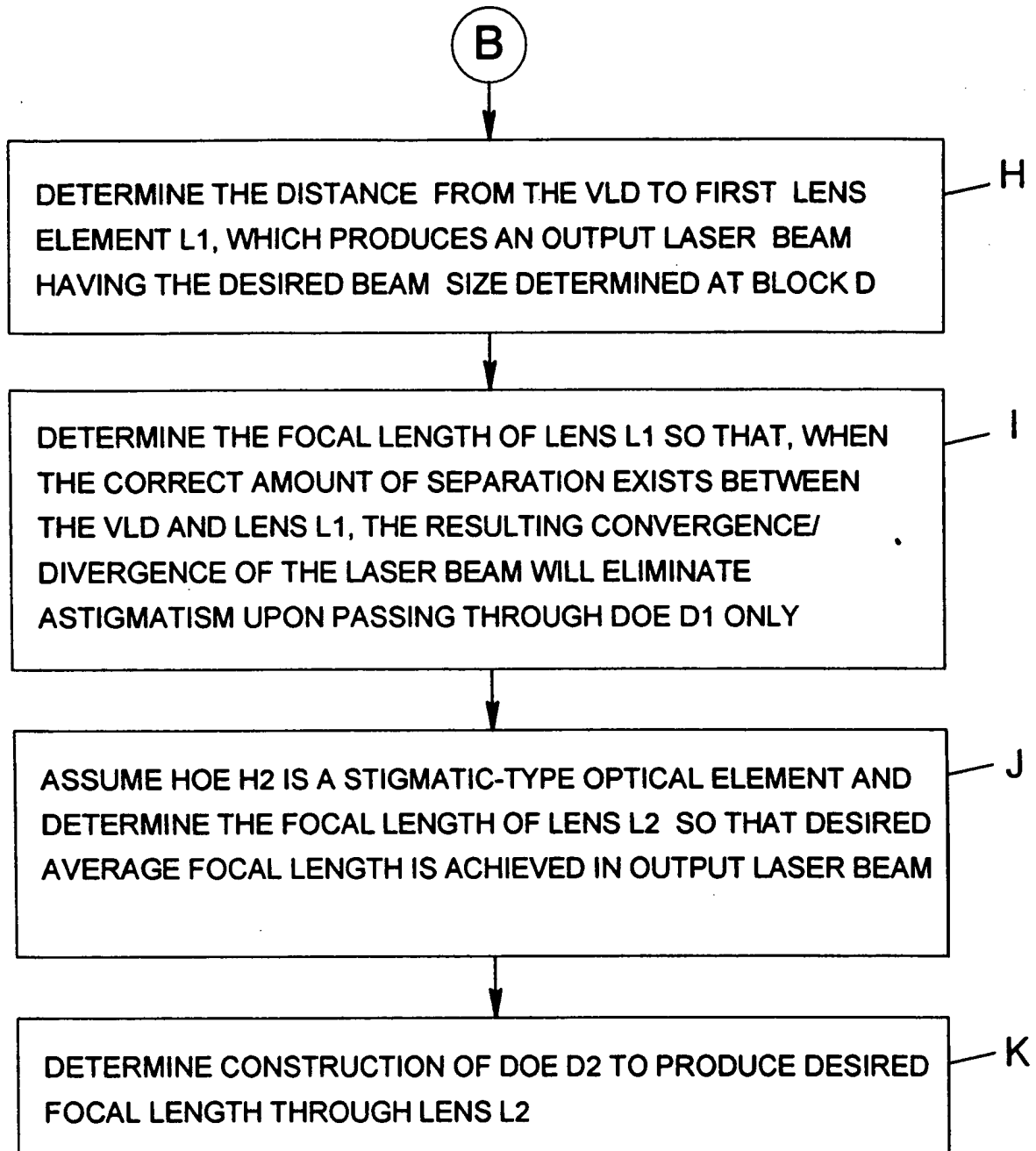


FIG. 3C3

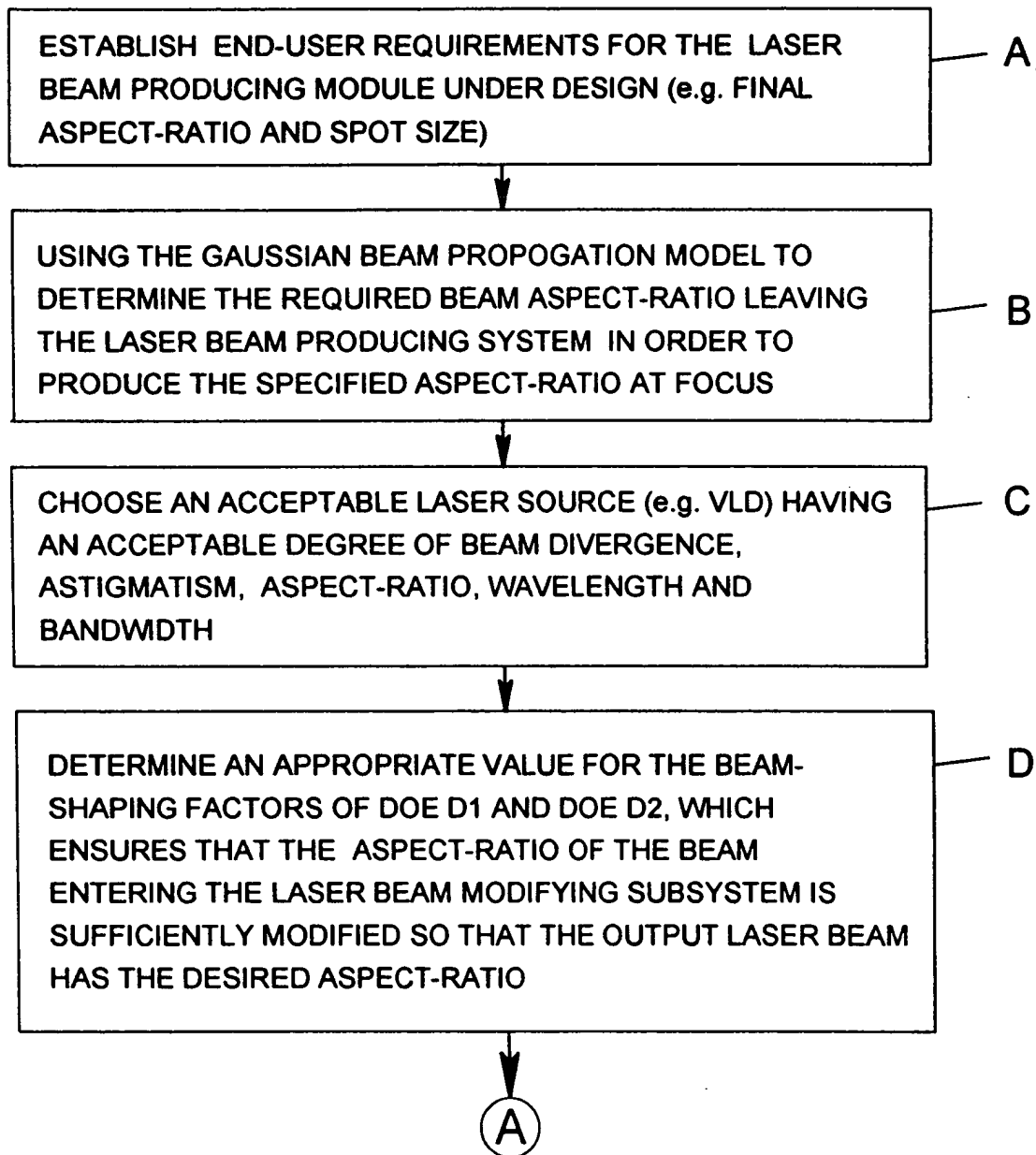


FIG. 3D1

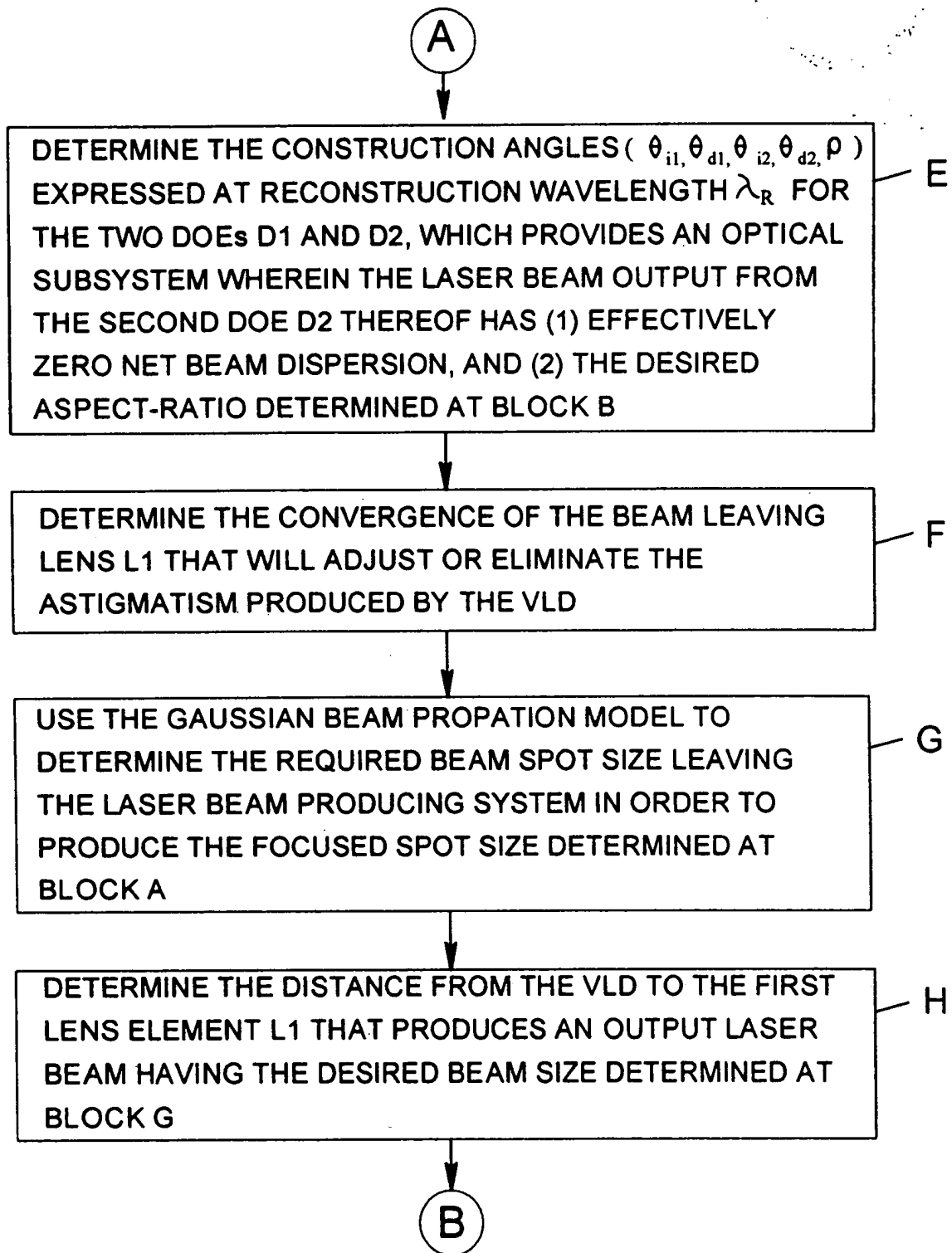


FIG. 3D2

B



DETERMINE THE FOCAL LENGTH OF THE LENS ELEMENT L1
THAT PRODUCES A BEAM WITH THE CONVERGENCE
DETERMINED IN BLOCK F

I

FIG. 3D3

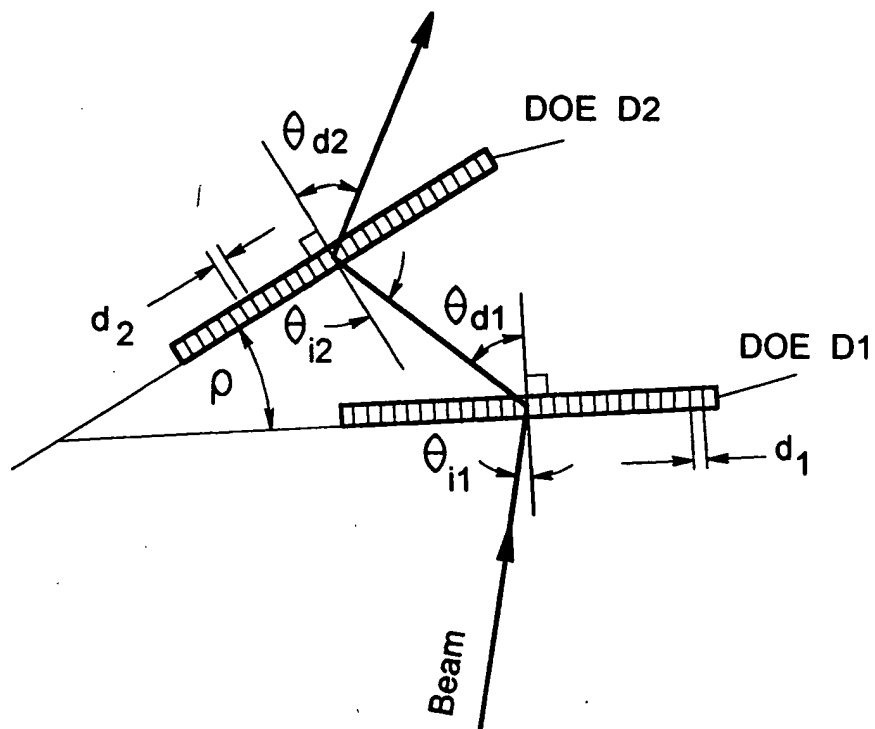


FIG. 3E

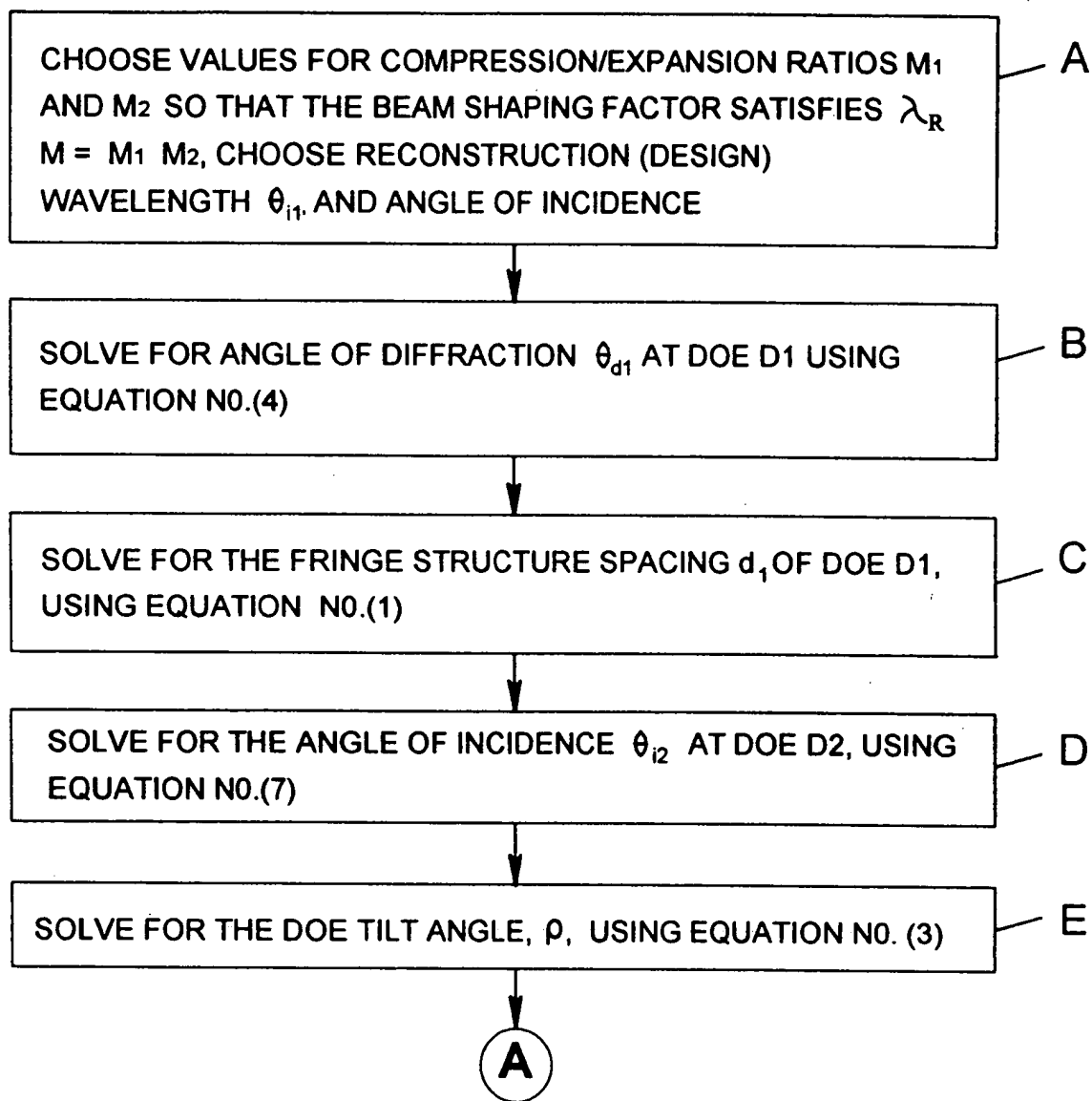


FIG. 3F1

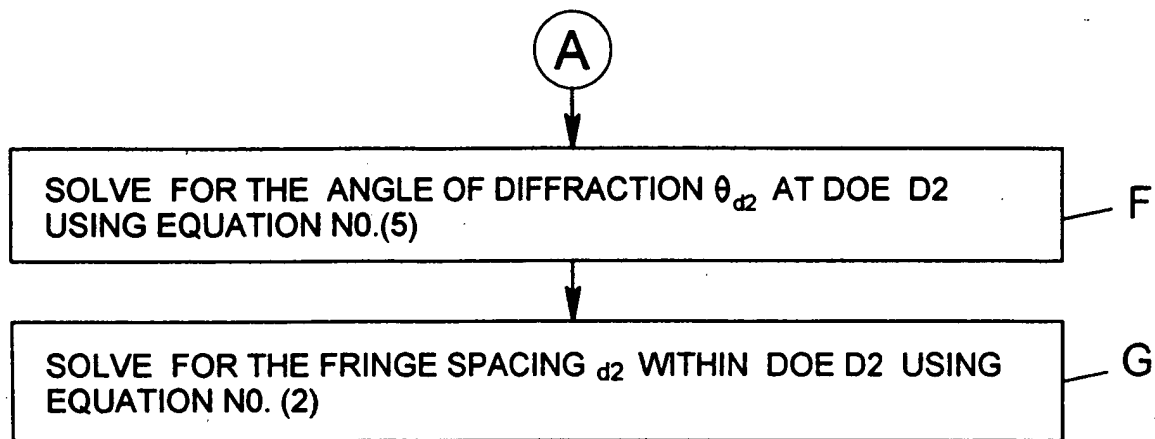


FIG. 3F2

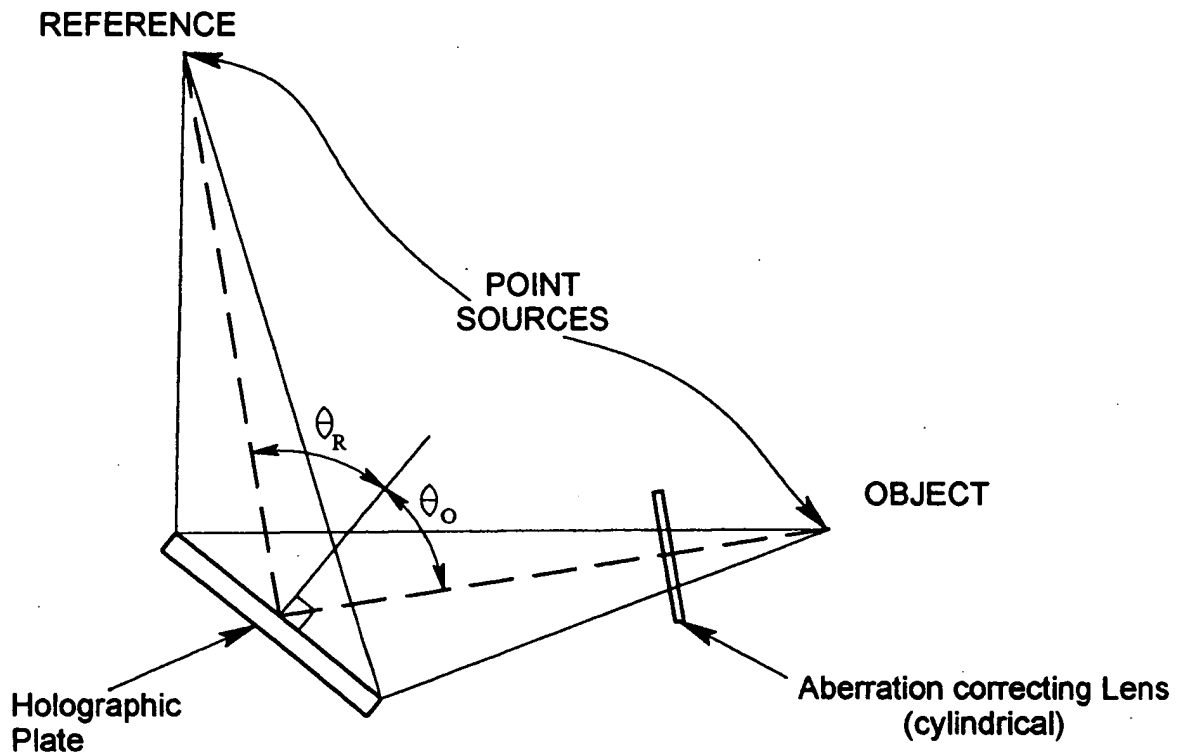
CONVERT THE DESIGN PARAMETERS θ_{i1} , θ_{d1} , θ_{i2} , θ_{d2} , (AND f_2) EXPRESSED AT THE RECONSTRUCTION WAVELENGTH λ_R , INTO CONSTRUCTION PARAMETERS EXPRESSED AT THE CONSTRUCTION WAVELENGTH λ_c , NAMELY: θ_{O1} , θ_{R1} , FOR HOE H1; AND θ_{O2} , θ_{R2} , FOR HOE H2

A

IN THE CASE OF VARIABLE SPATIAL FREQUENCY DOEs, USE COMPUTER-RAY TRACING TO DETERMINE THE DISTANCES OF THE OBJECT AND REFERENCE (BEAM) SOURCES RELATIVE TO THE HOLOGRAPHIC RECORDING MEDIUM (AS WELL AS THE DISTANCES OF ANY ABERRATION-CORRECTING LENSES THEREFROM) EMPLOYED DURING THE HOLOGRAPHIC RECORDING PROCESS

B

FIG. 4A



θ_R = REFERENCE BEAM ANGLE OF INCIDENCE

θ_O = OBJECT BEAM ANGLE OF INCIDENCE

FIG. 4B

FORMULATE WITHIN A DIGITAL COMPUTER SYSTEM, A MATHEMATICAL DESCRIPTION OF THE OBJECT AND REFERENCE BEAM WAVEFRONTS USED TO CONSTRUCT DOE D1 AND DOE D2, DURING OPTICAL FORMATION THEREOF WHEN USING THE HOLOGRAPHIC RECORDING METHOD SHOWN IN FIG. 4B

A

USE THE DIGITAL COMPUTER SYSTEM TO FORMULATE A MATHEMATICAL DESCRIPTION OF THE INTERFERENCE PATTERN THAT IS GENERATED BY MATHEMATICALLY ADDING THE MATHEMATICAL MODEL OF THE OBJECT BEAM WAVEFRONT TO THE REFERENCE BEAM WAVEFRONT, TO PROVIDE A SPATIAL FUNCTION OF THE COMPUTER GENERATED / REPRESENTED INTERFERENCE PATTERN

B

USE THE DIGITAL COMPUTER SYSTEM TO SAMPLE THE SPATIAL FUNCTION OF THE COMPUTER GENERATED / REPRESENTED INTERFERENCE PATTERN ALONG THE X AND Y DIRECTIONS THEREOF TO PRODUCE A LARGE SET OF SAMPLED VALUES OF VARYING AMPLITUDE TRANSMITTANCE ASSOCIATED WITH THE COMPUTER GENERATED INTERFERENCE PATTERN

C

A

FIG. 4C1

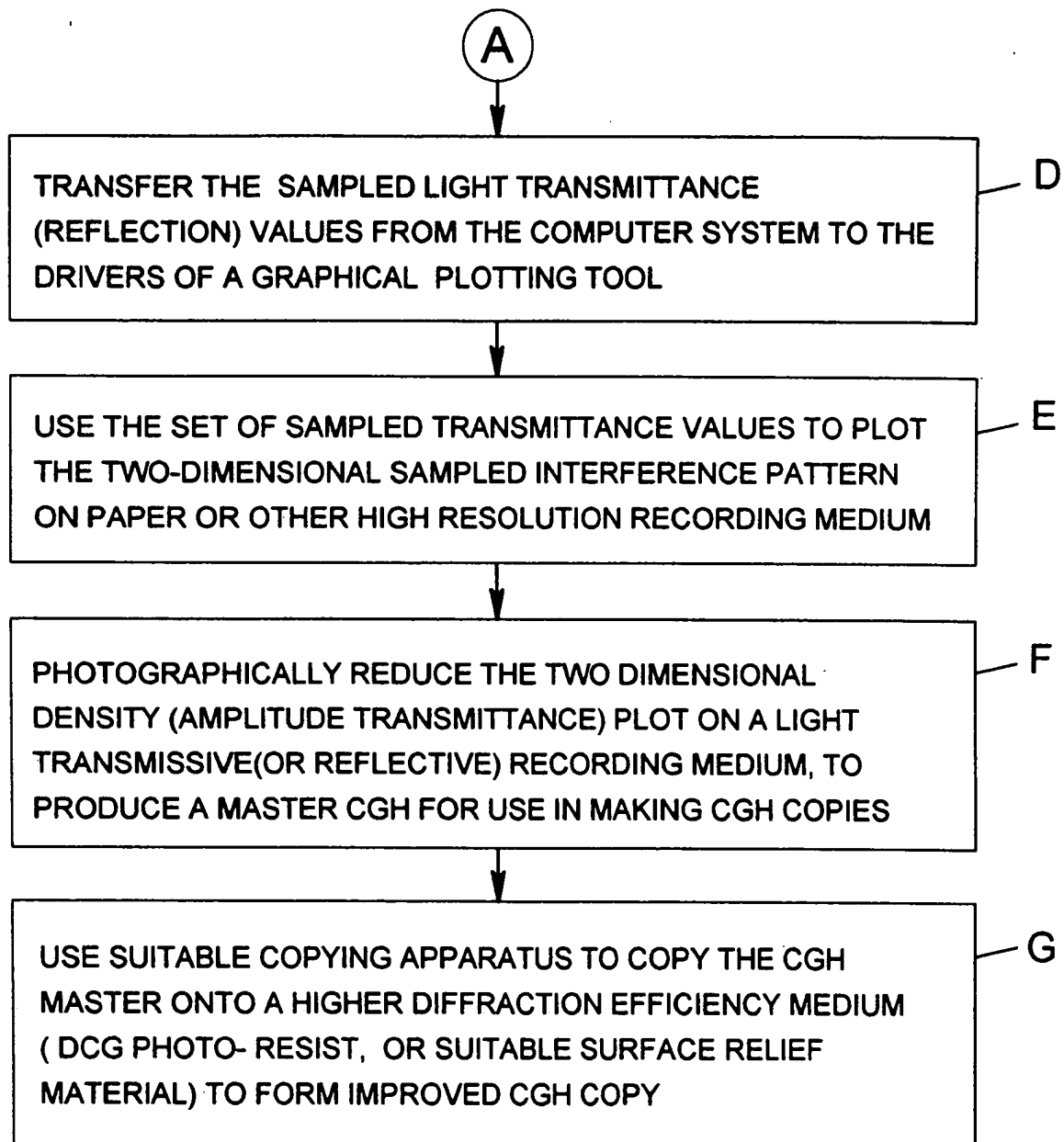


FIG. 4C2

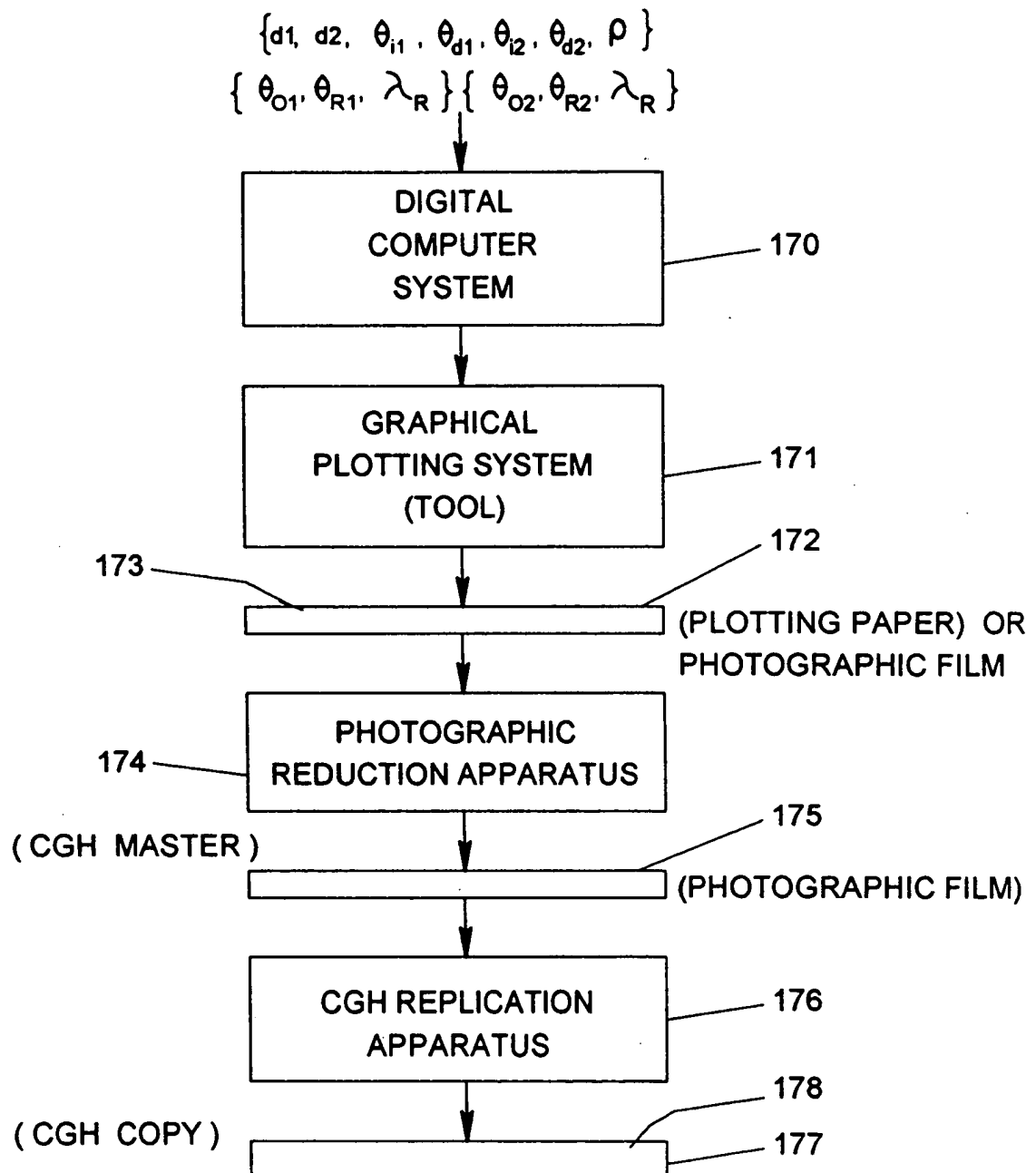


FIG. 4D

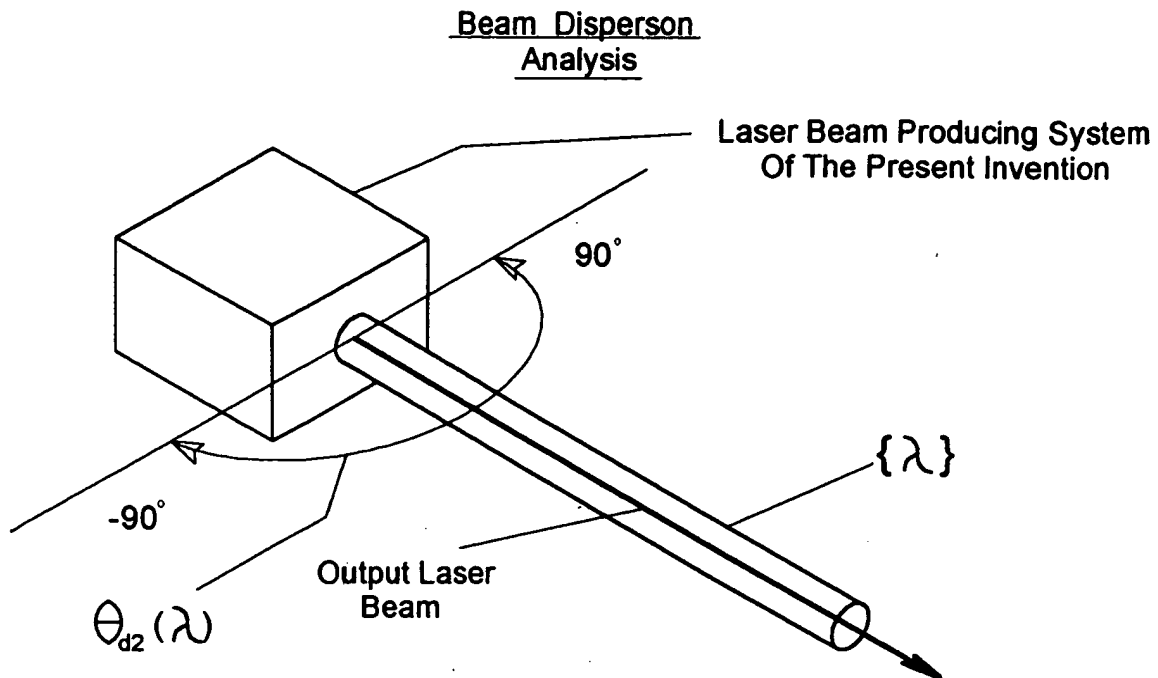


FIG. 5A

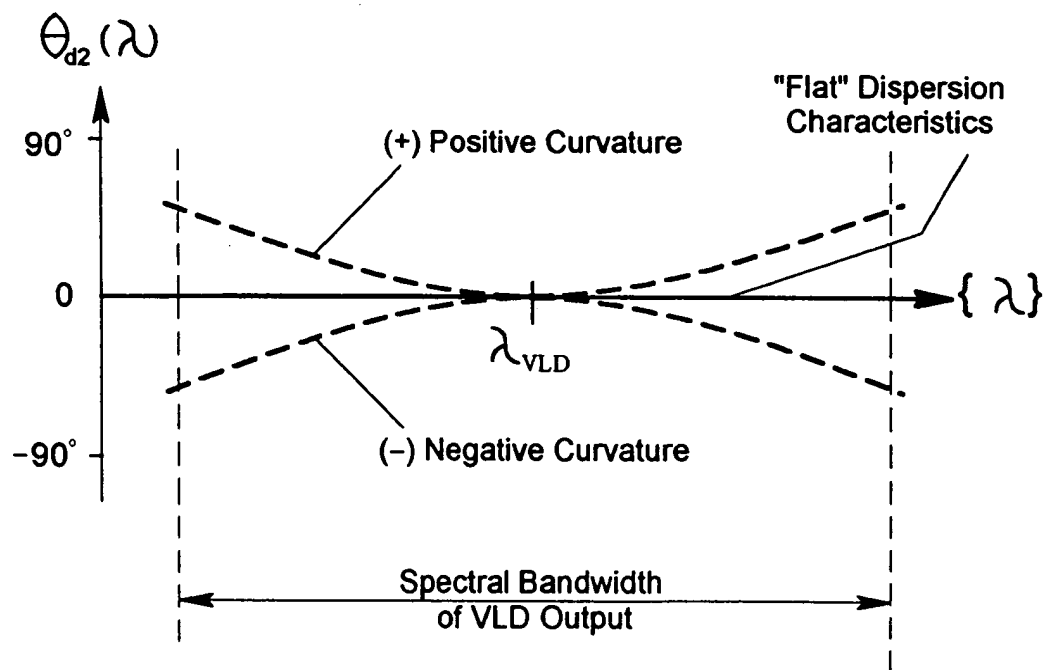


FIG. 5B

FIG. 5B1 is a graph showing the dispersion of the angle of diffraction θ_{d2} as a function of the wavelength λ . The graph shows that the angle of diffraction θ_{d2} increases as the wavelength λ increases.

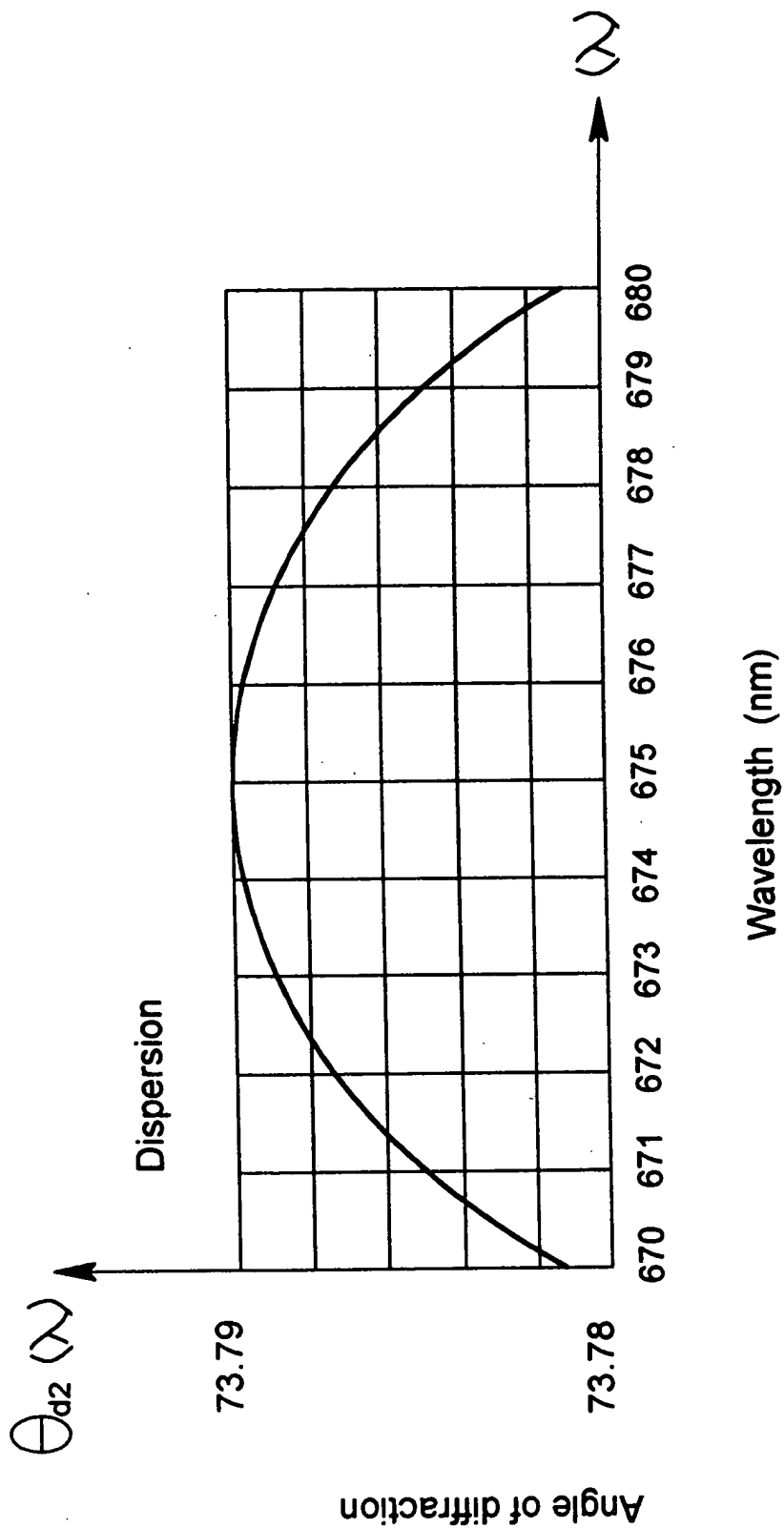


FIG. 5B1

1000 900 800 700 600 500 400 300 200 100 0

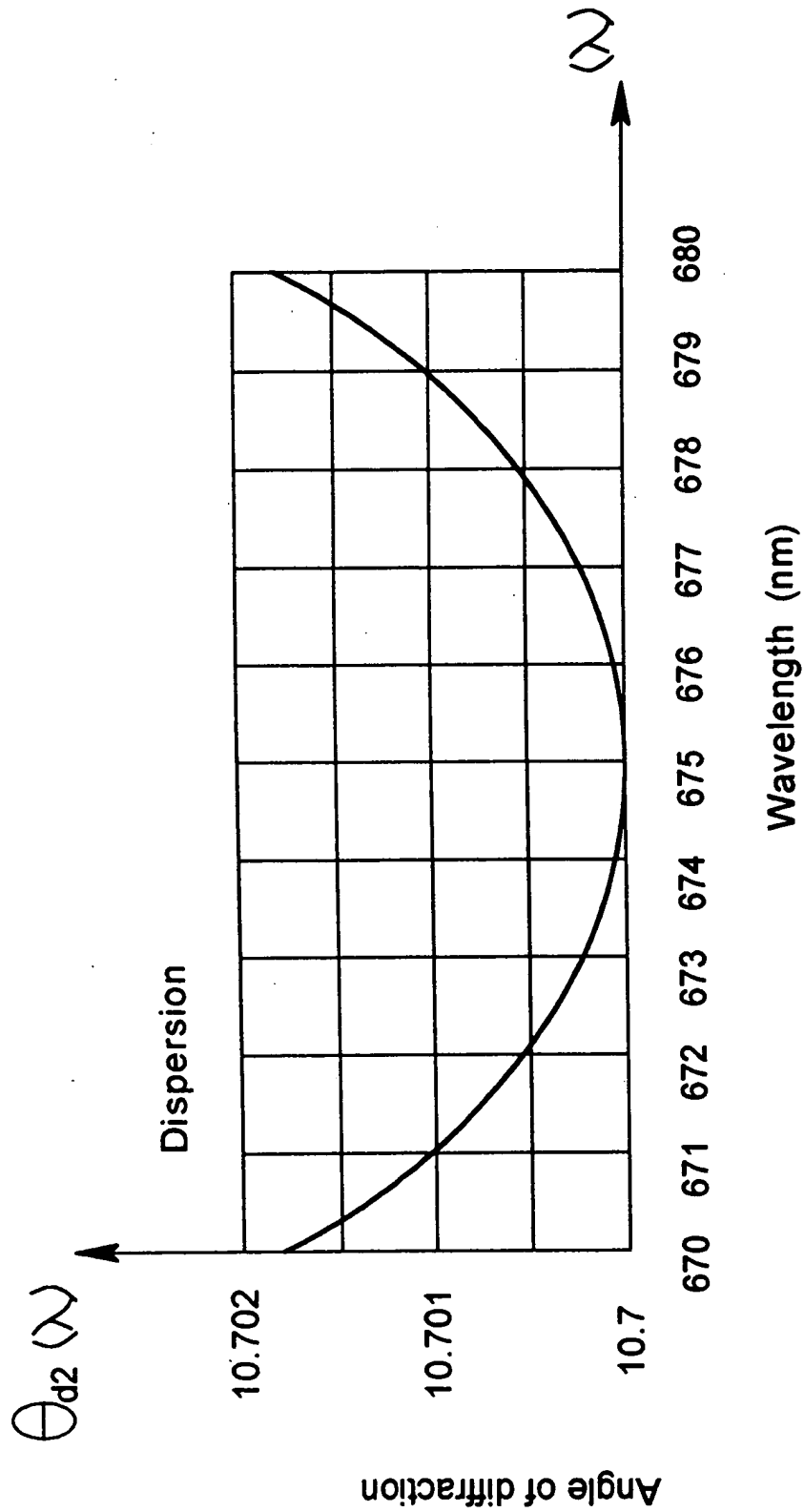
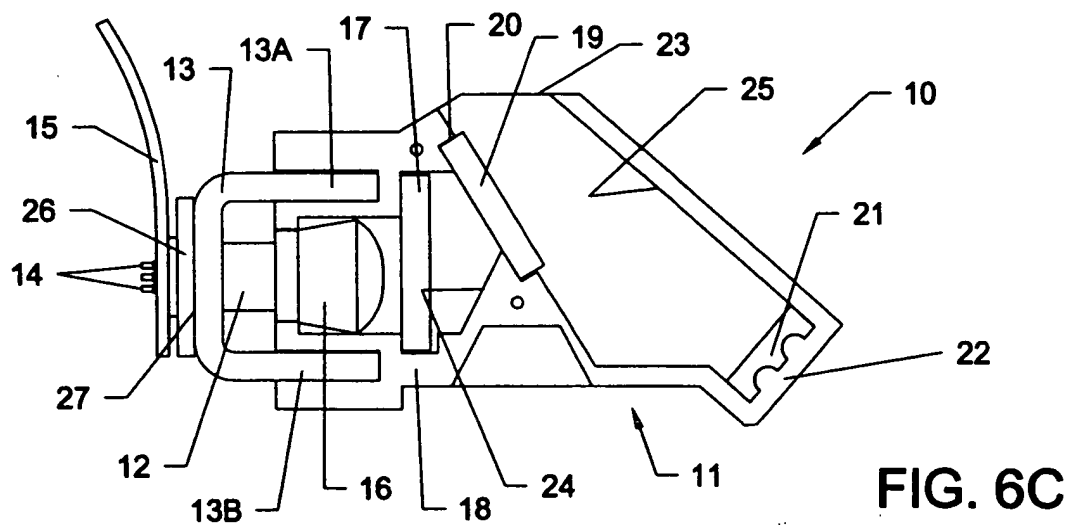
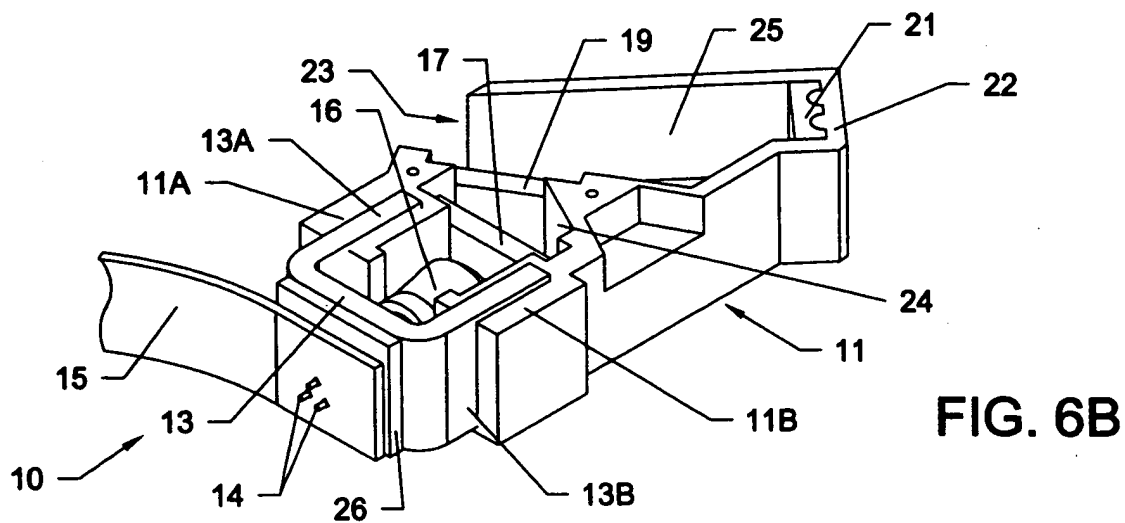
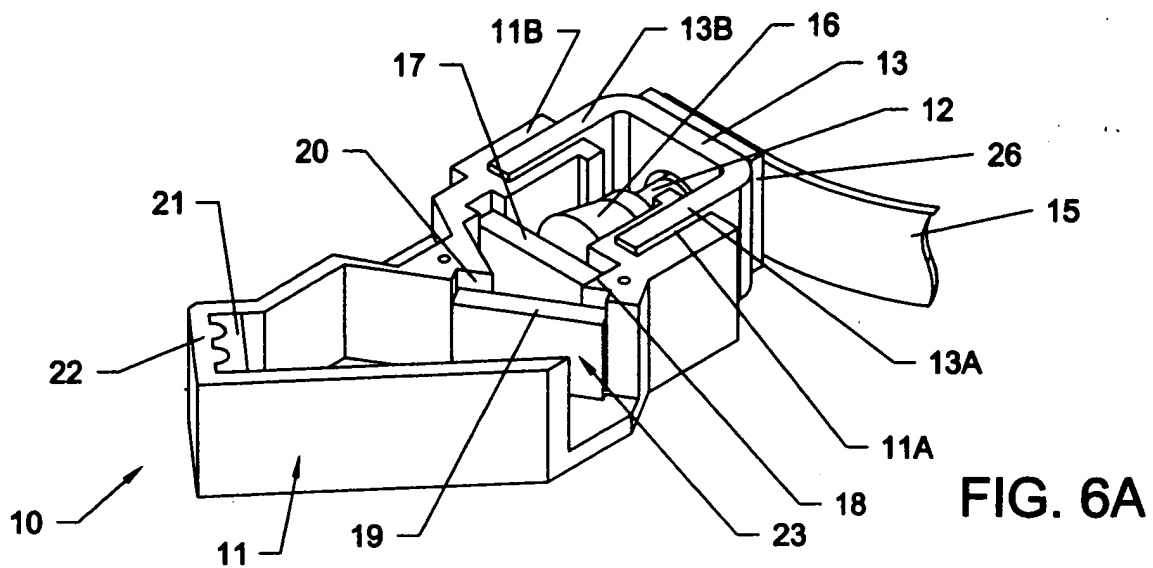


FIG. 5B2



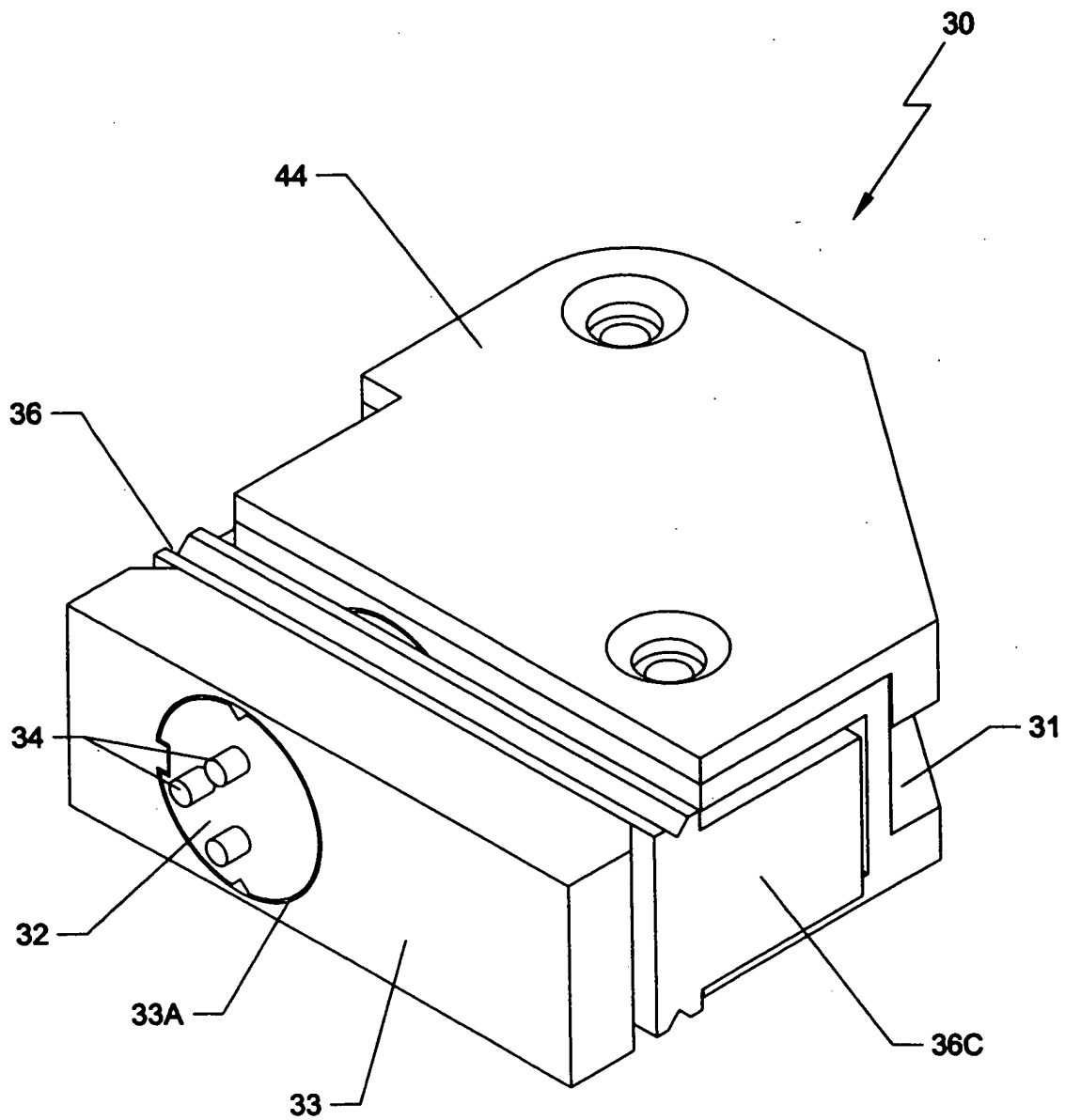


FIG. 7A

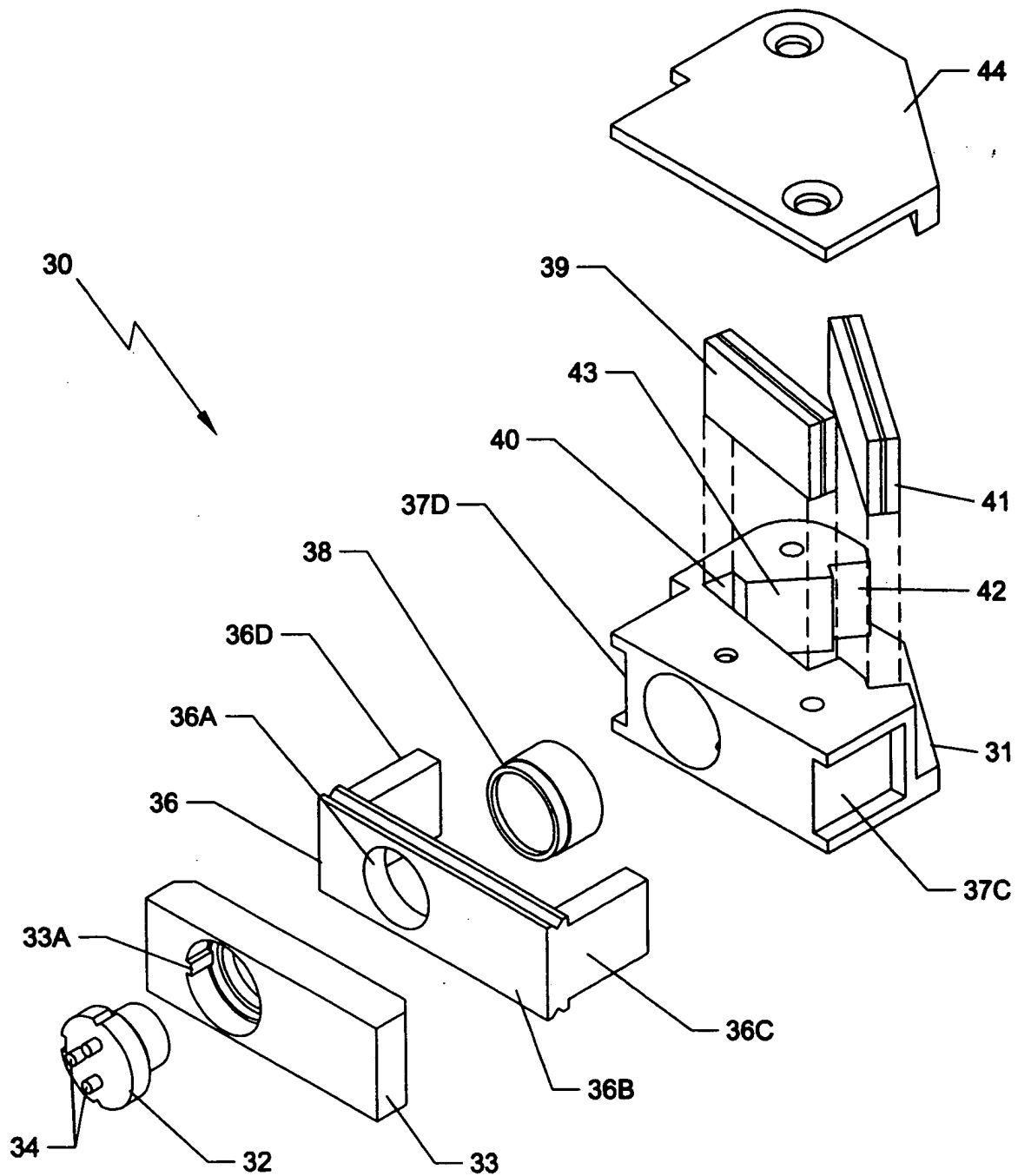


FIG. 7B

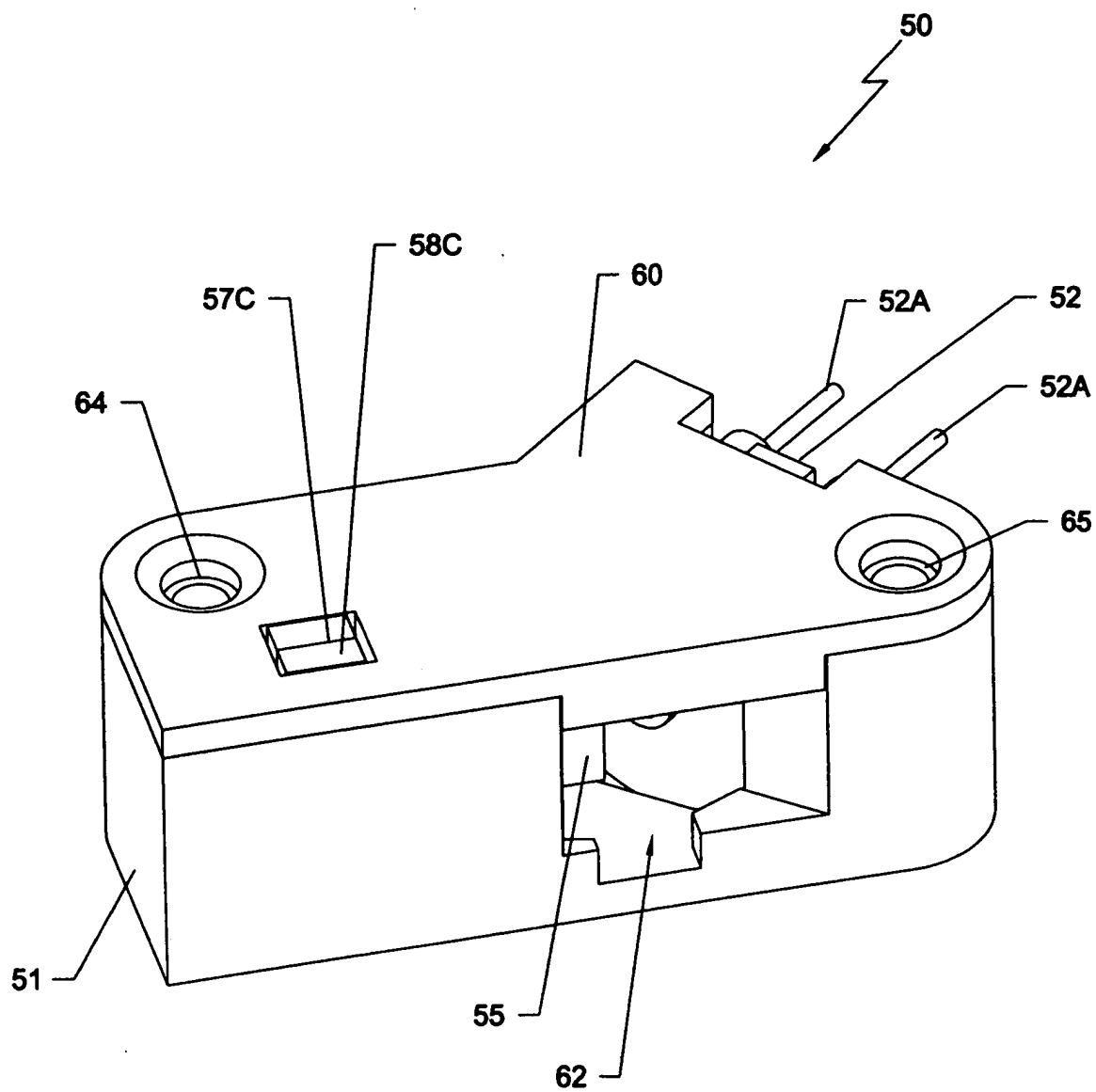


FIG. 8A

FIG. 8B is a perspective view of the assembly 50 in a disassembled state. The assembly 50 includes a base 51, a first member 52, a second member 53, a third member 54, a fourth member 55, a fifth member 56, a sixth member 57, a seventh member 58, an eighth member 59, a ninth member 60, a tenth member 61, an eleventh member 62, a twelfth member 63, a thirteenth member 64, a fourteenth member 65, a fifteenth member 66, a sixteenth member 67, and a seventeenth member 68. The first member 52 is a cylindrical component with a flange 52A and a central bore 52B. The second member 53 is a rectangular block with a central bore 53A and a flange 53B. The third member 54 is a rectangular block with a central bore 54A and a flange 54B. The fourth member 55 is a rectangular block with a central bore 55A and a flange 55B. The fifth member 56 is a rectangular block with a central bore 56A and a flange 56B. The sixth member 57 is a rectangular block with a central bore 57A and a flange 57B. The seventh member 58 is a rectangular block with a central bore 58A and a flange 58B. The eighth member 59 is a rectangular block with a central bore 59A and a flange 59B. The ninth member 60 is a rectangular block with a central bore 60A and a flange 60B. The tenth member 61 is a rectangular block with a central bore 61A and a flange 61B. The eleventh member 62 is a rectangular block with a central bore 62A and a flange 62B. The twelfth member 63 is a rectangular block with a central bore 63A and a flange 63B. The thirteenth member 64 is a rectangular block with a central bore 64A and a flange 64B. The fourteenth member 65 is a rectangular block with a central bore 65A and a flange 65B. The fifteenth member 66 is a rectangular block with a central bore 66A and a flange 66B. The sixteenth member 67 is a rectangular block with a central bore 67A and a flange 67B. The seventeenth member 68 is a rectangular block with a central bore 68A and a flange 68B.

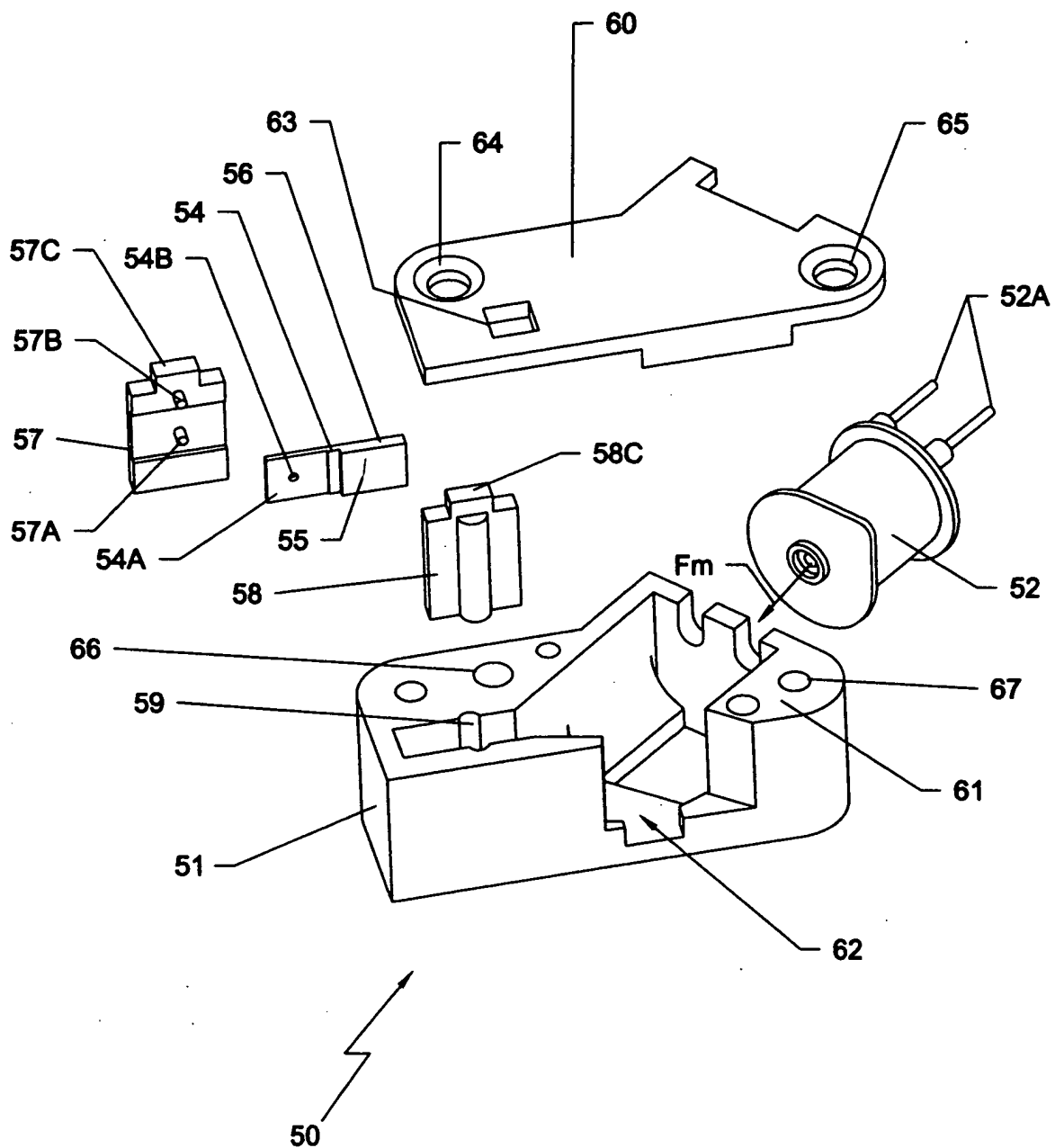


FIG. 8B

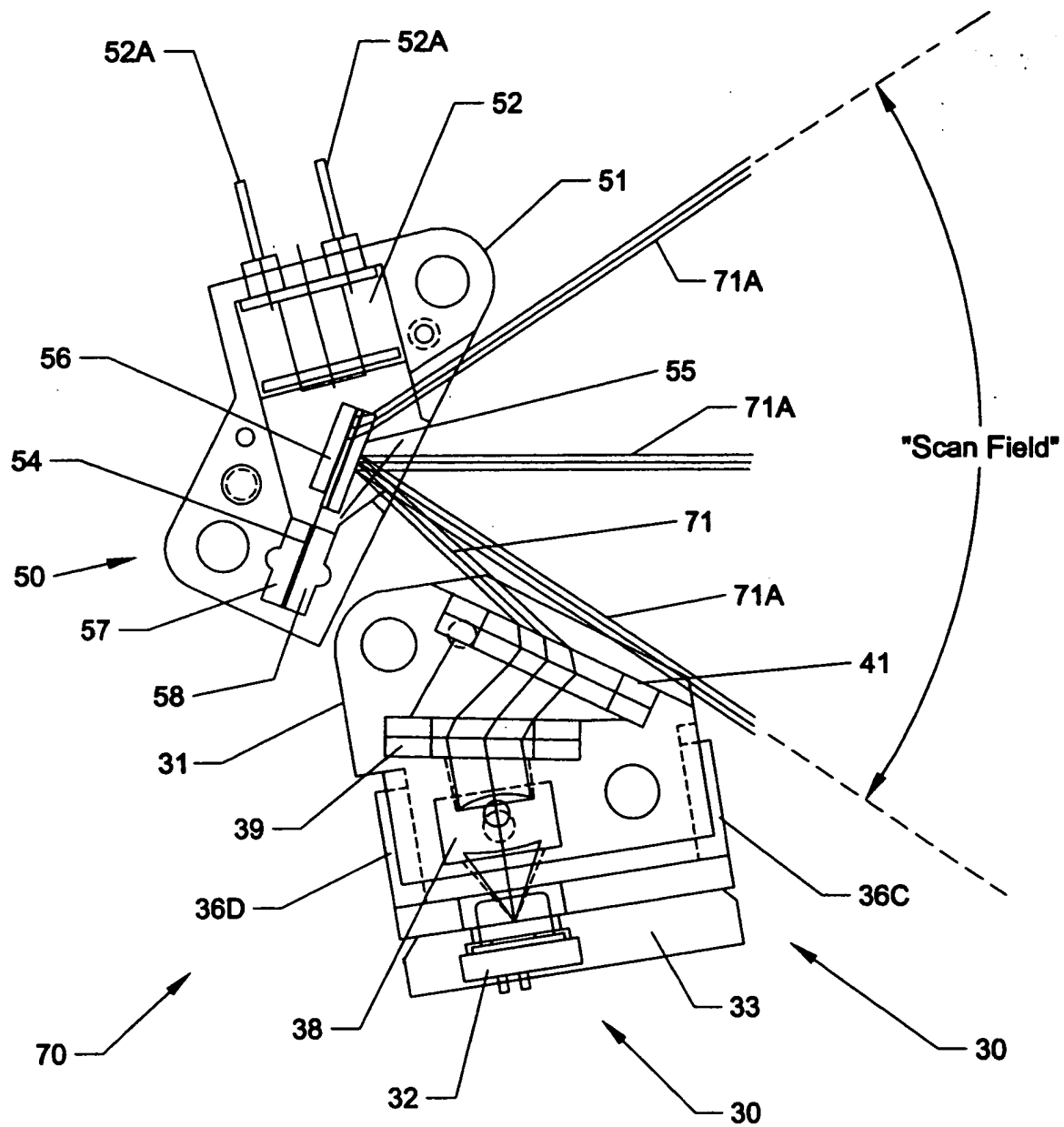


FIG. 9

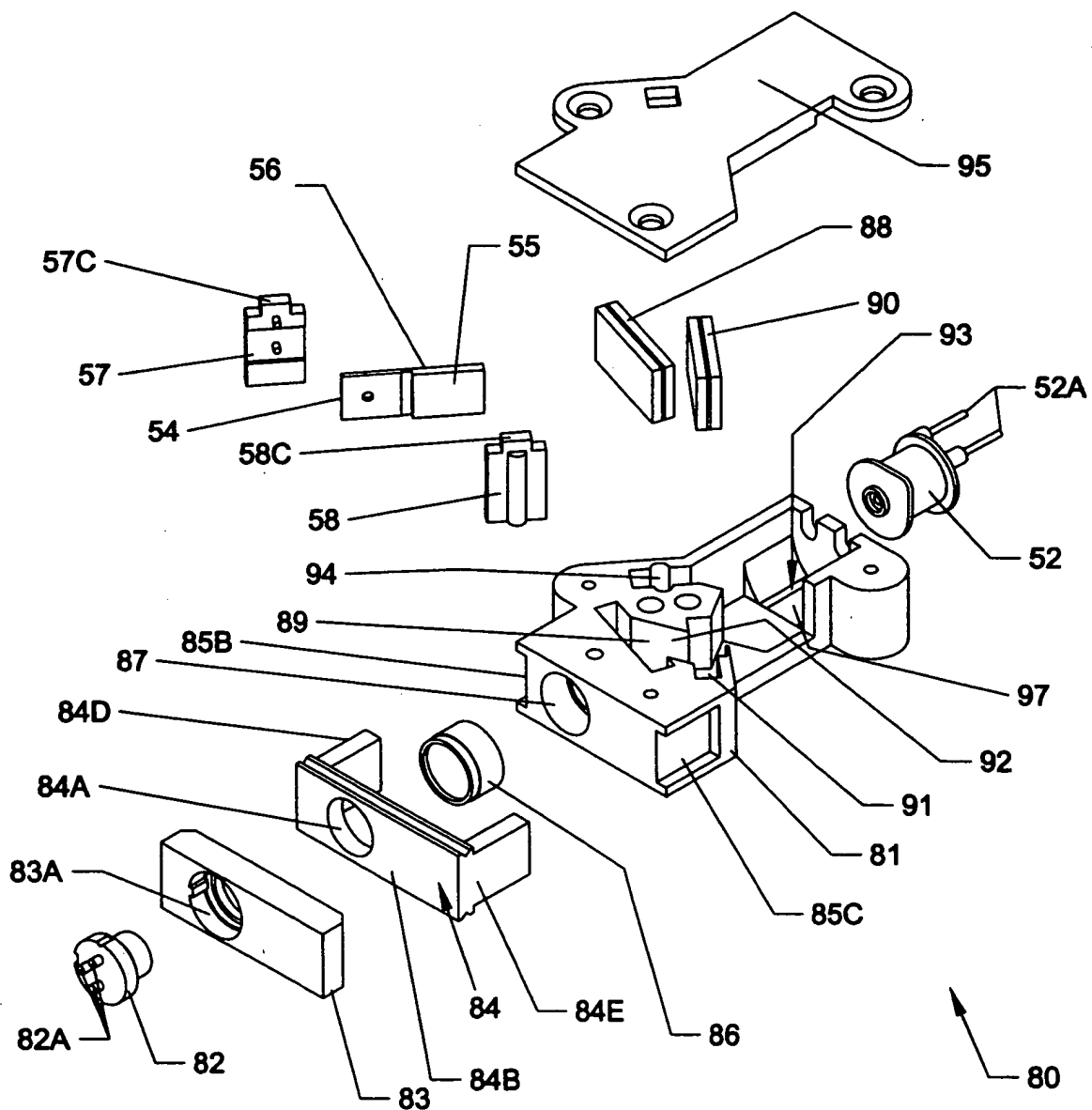


FIG. 10B

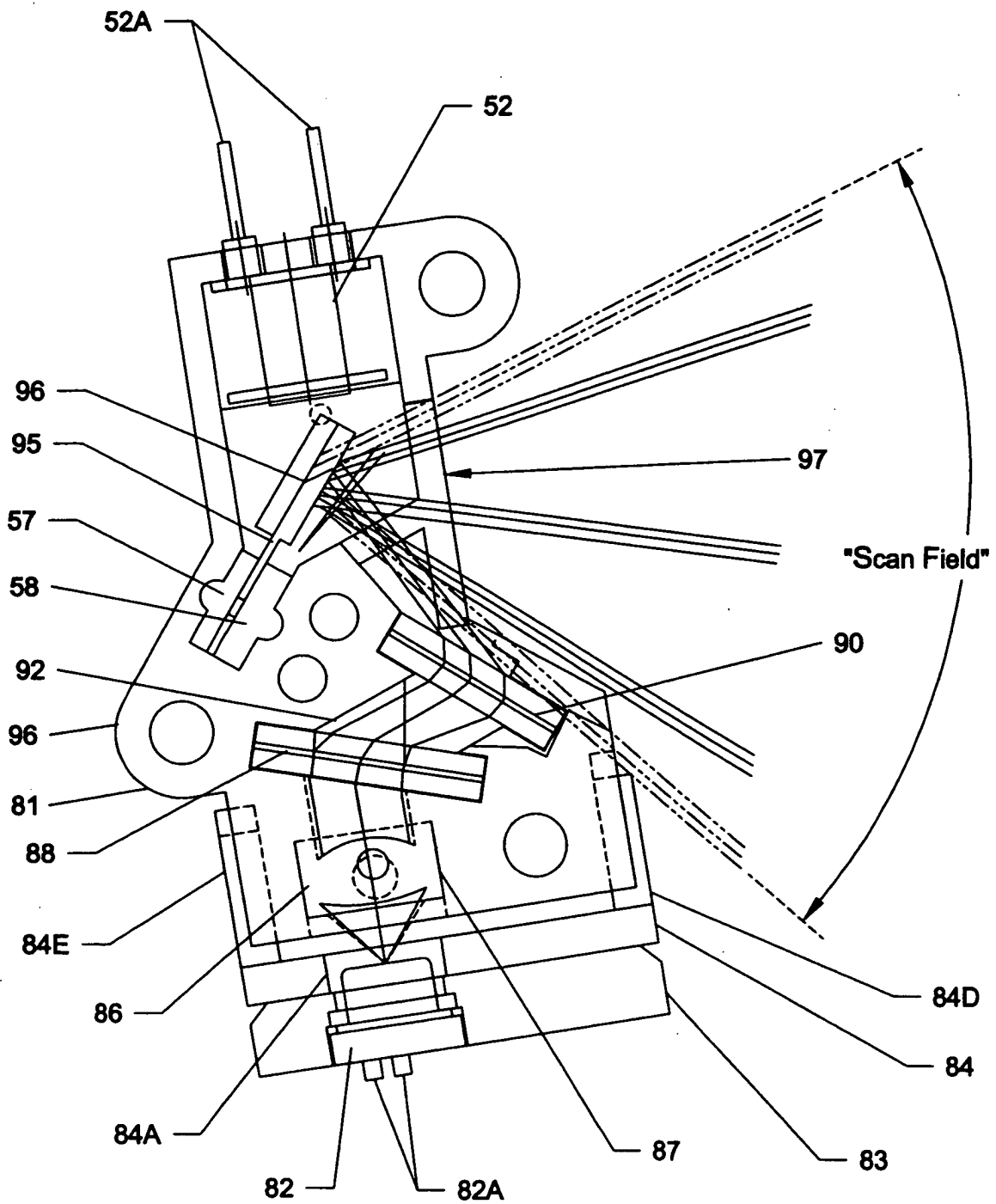


FIG. 10C

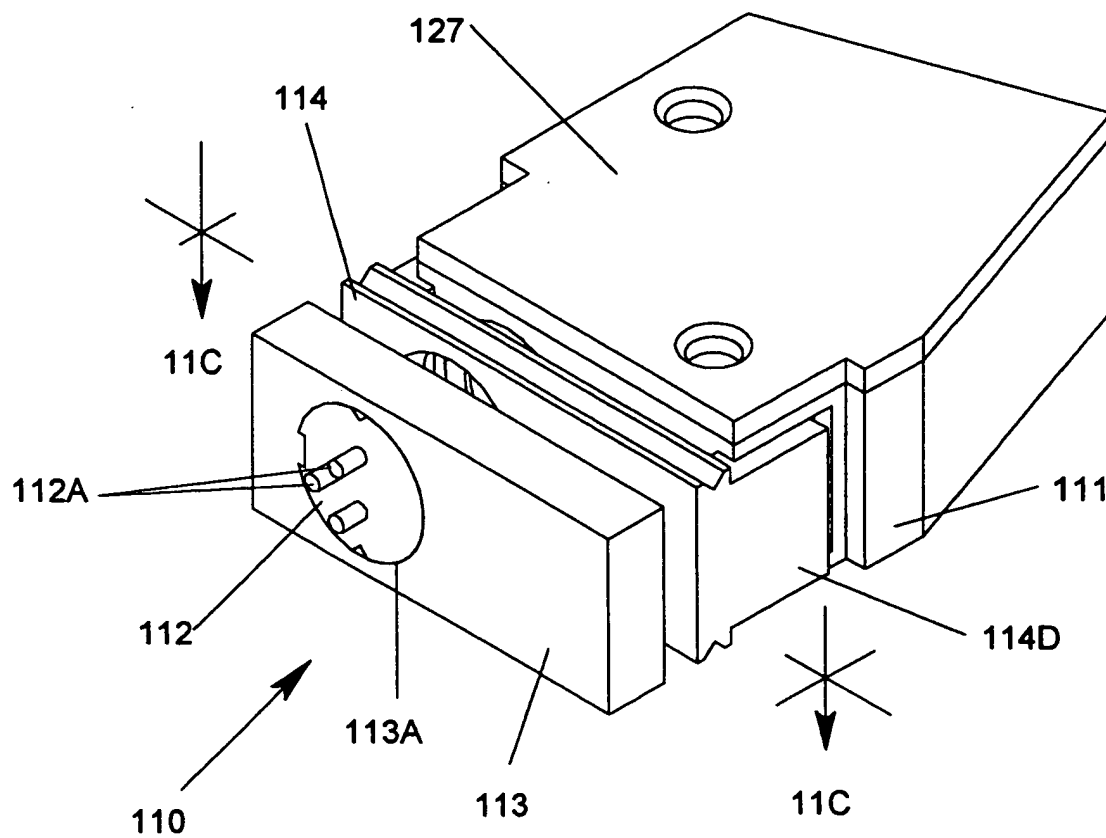


FIG. 11A

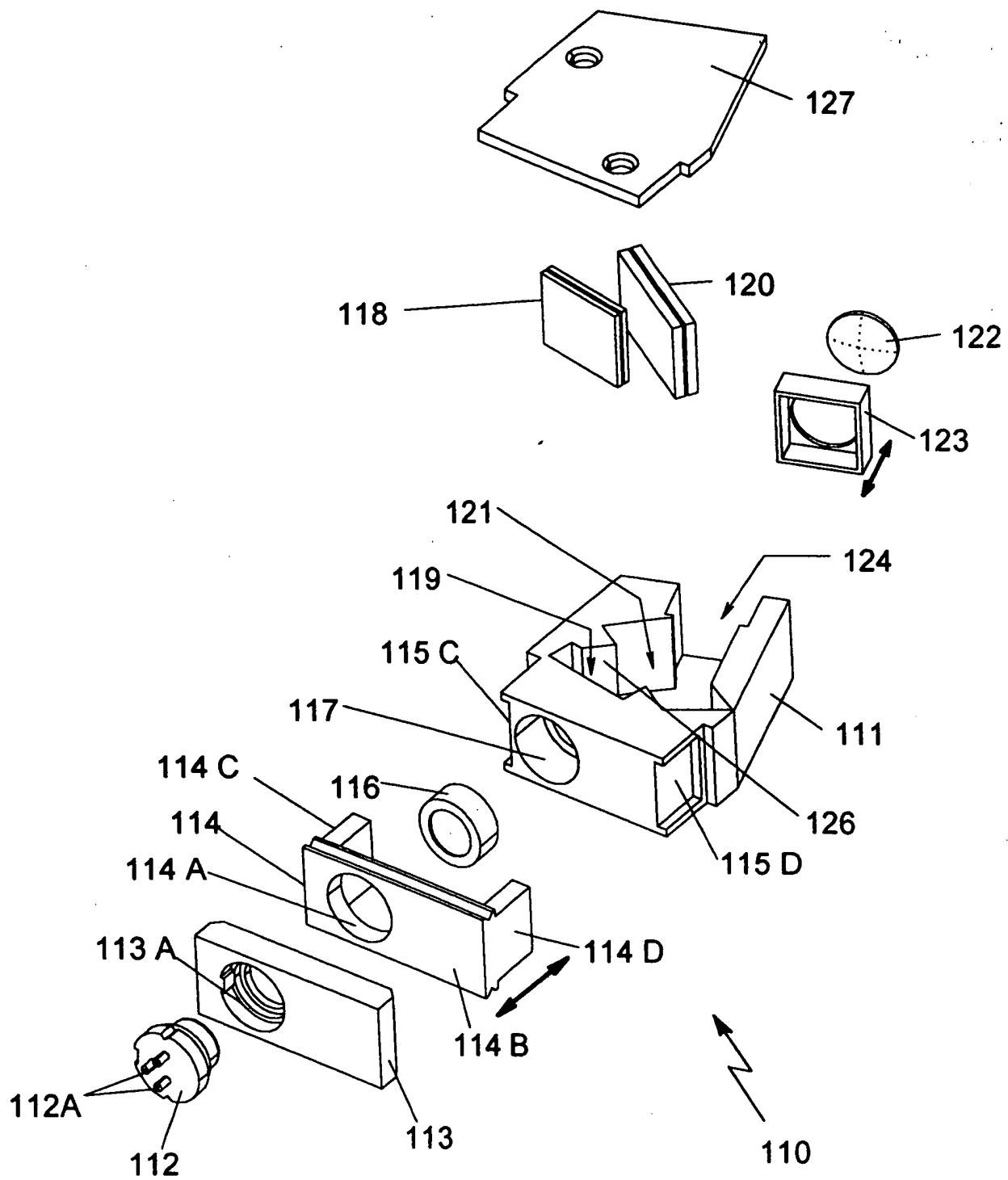


FIG. 11B

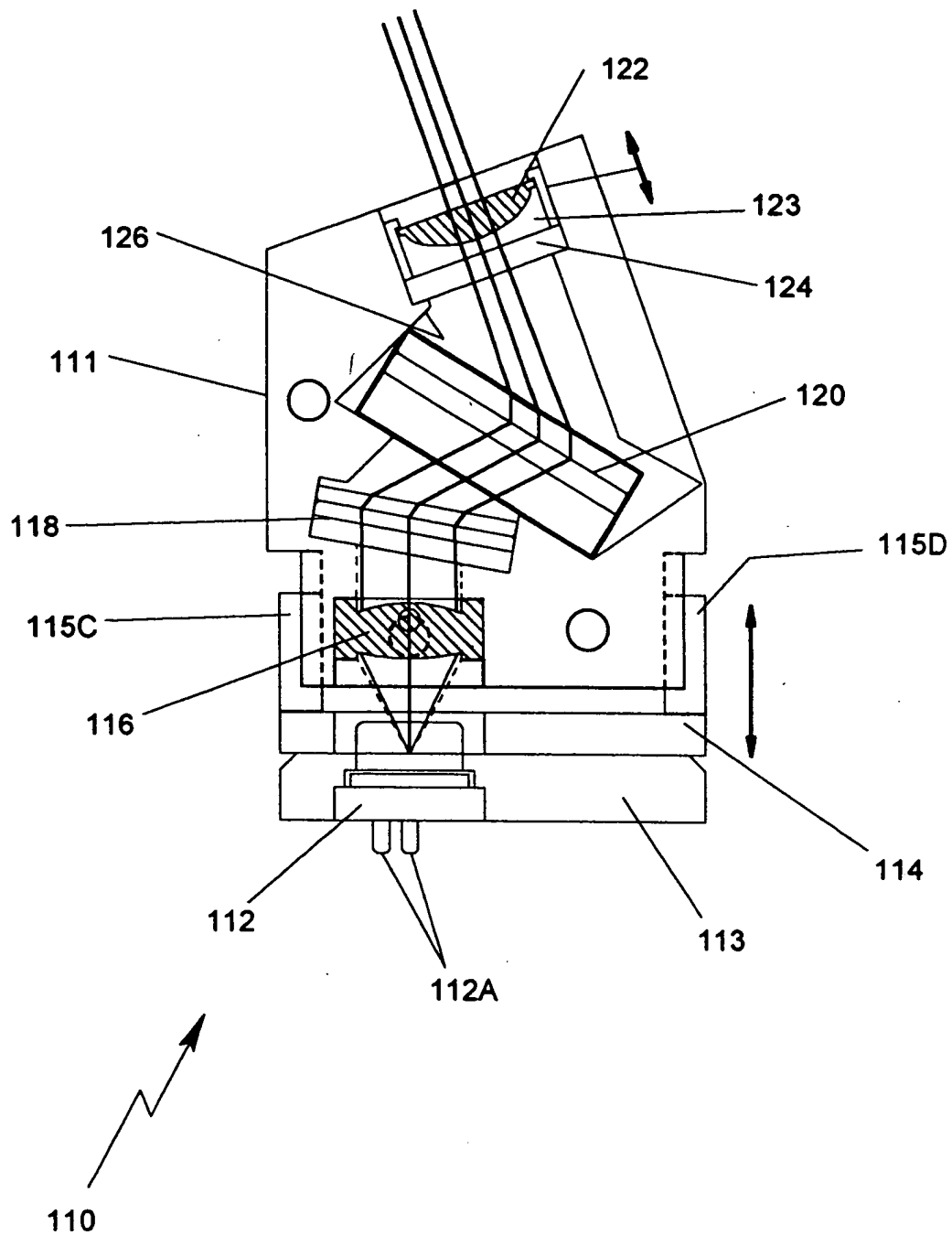


FIG. 11C

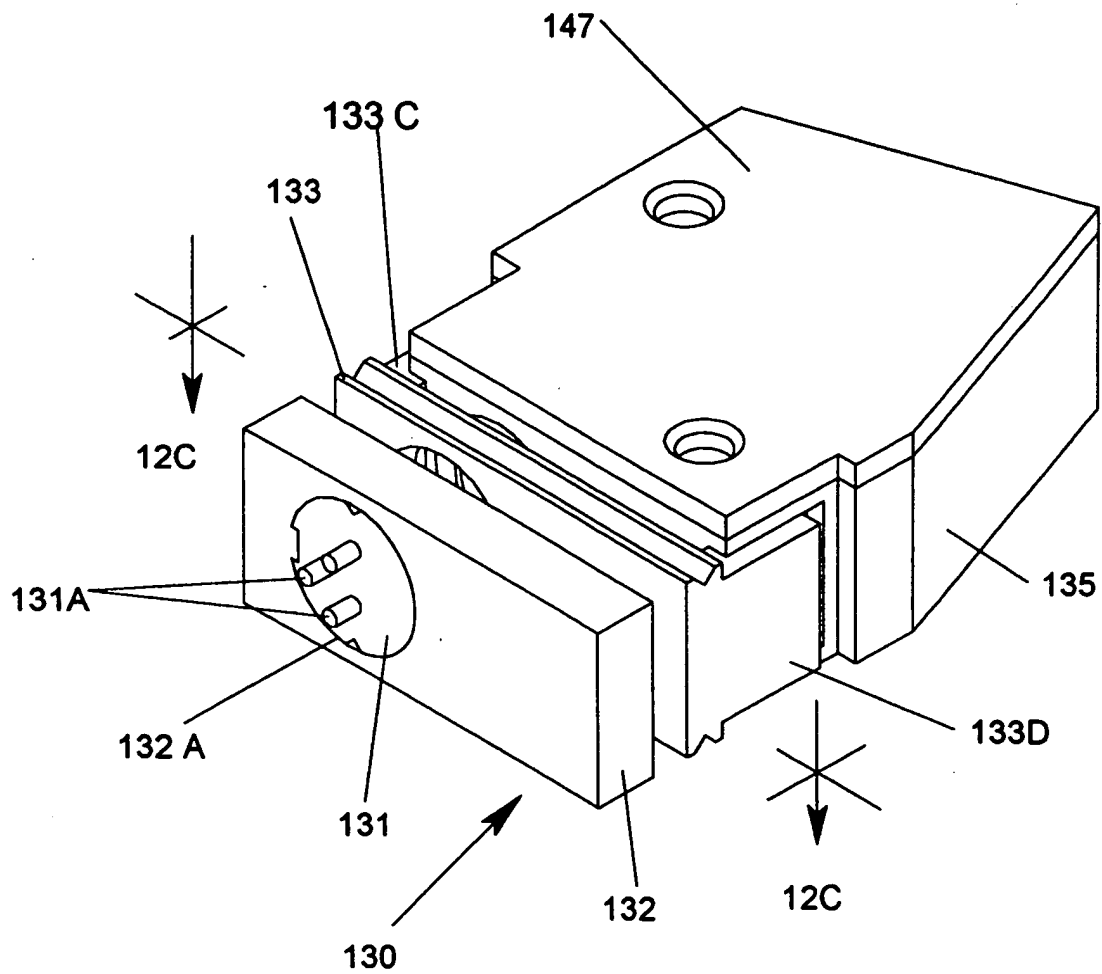


FIG. 12A

20250320 09:00:00

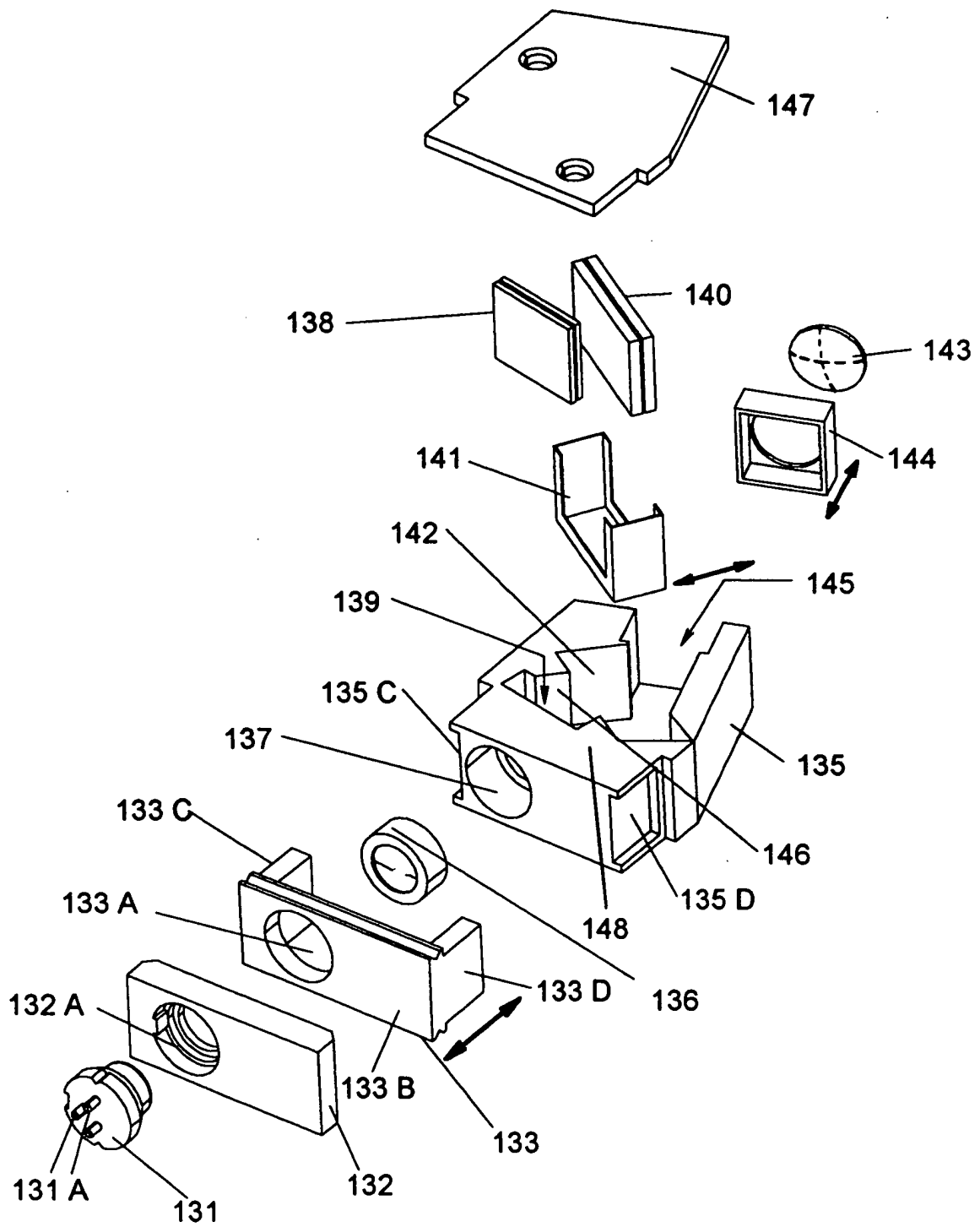


FIG. 12B

Category	Country	Year	Value	Unit
Agriculture	USA	1980	1.2	1000
	Canada	1980	0.8	1000
	UK	1980	0.5	1000
	France	1980	0.3	1000
Manufacturing	USA	1980	2.5	1000
	Canada	1980	1.8	1000
	UK	1980	1.2	1000
	France	1980	0.9	1000
Services	USA	1980	1.5	1000
	Canada	1980	1.0	1000
	UK	1980	0.7	1000
	France	1980	0.5	1000

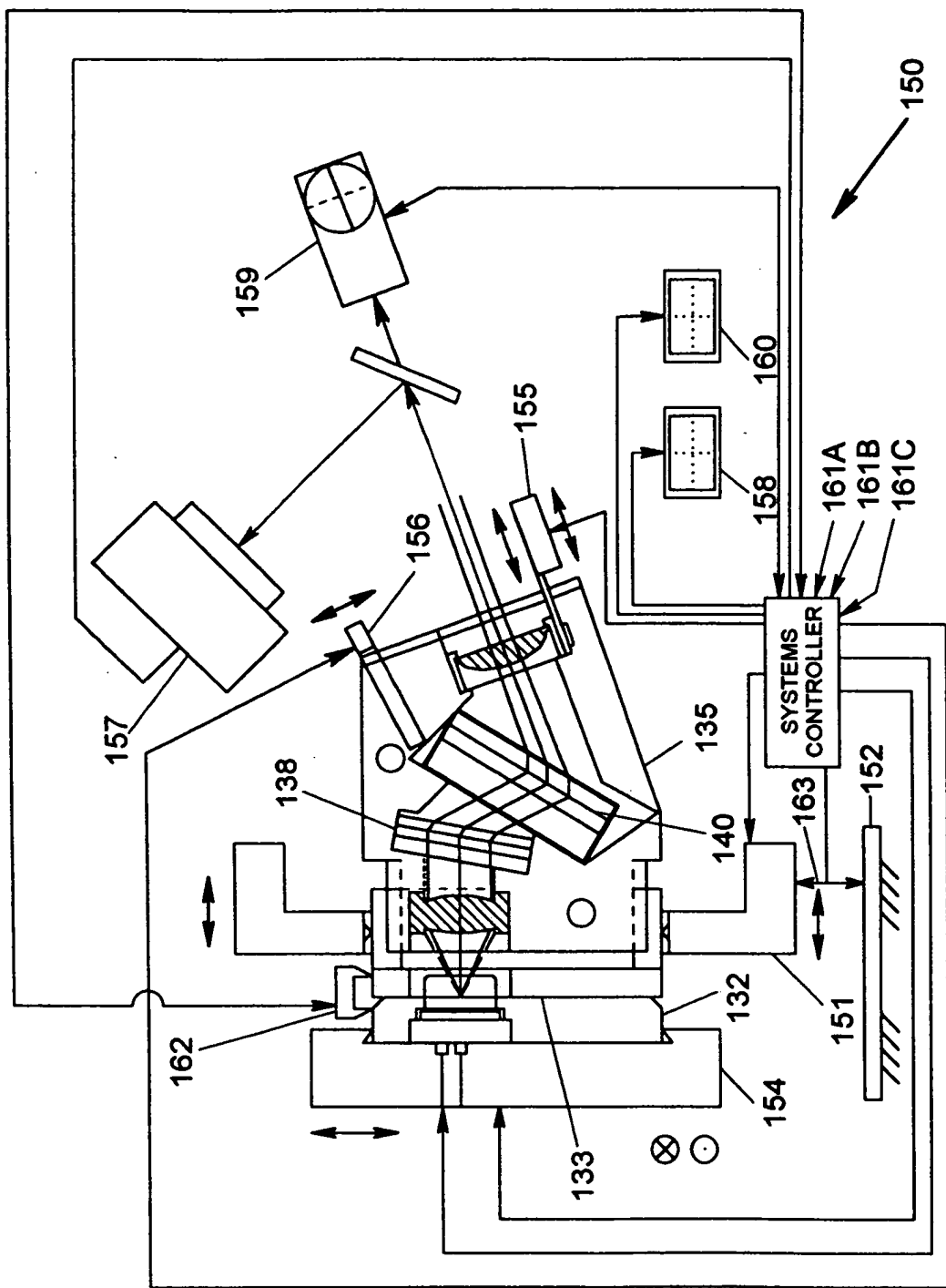


FIG. 13

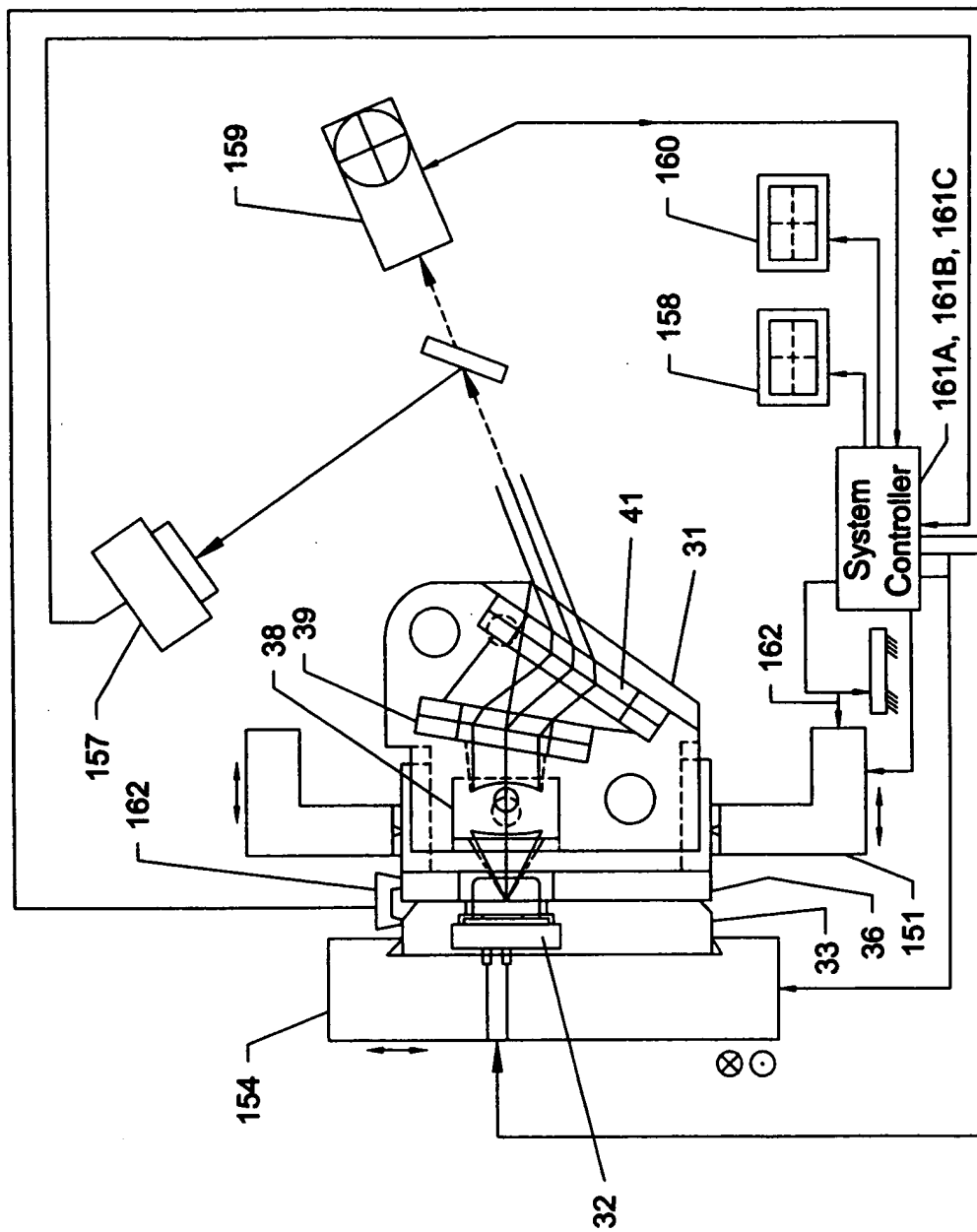


FIG. 14
(Case A)

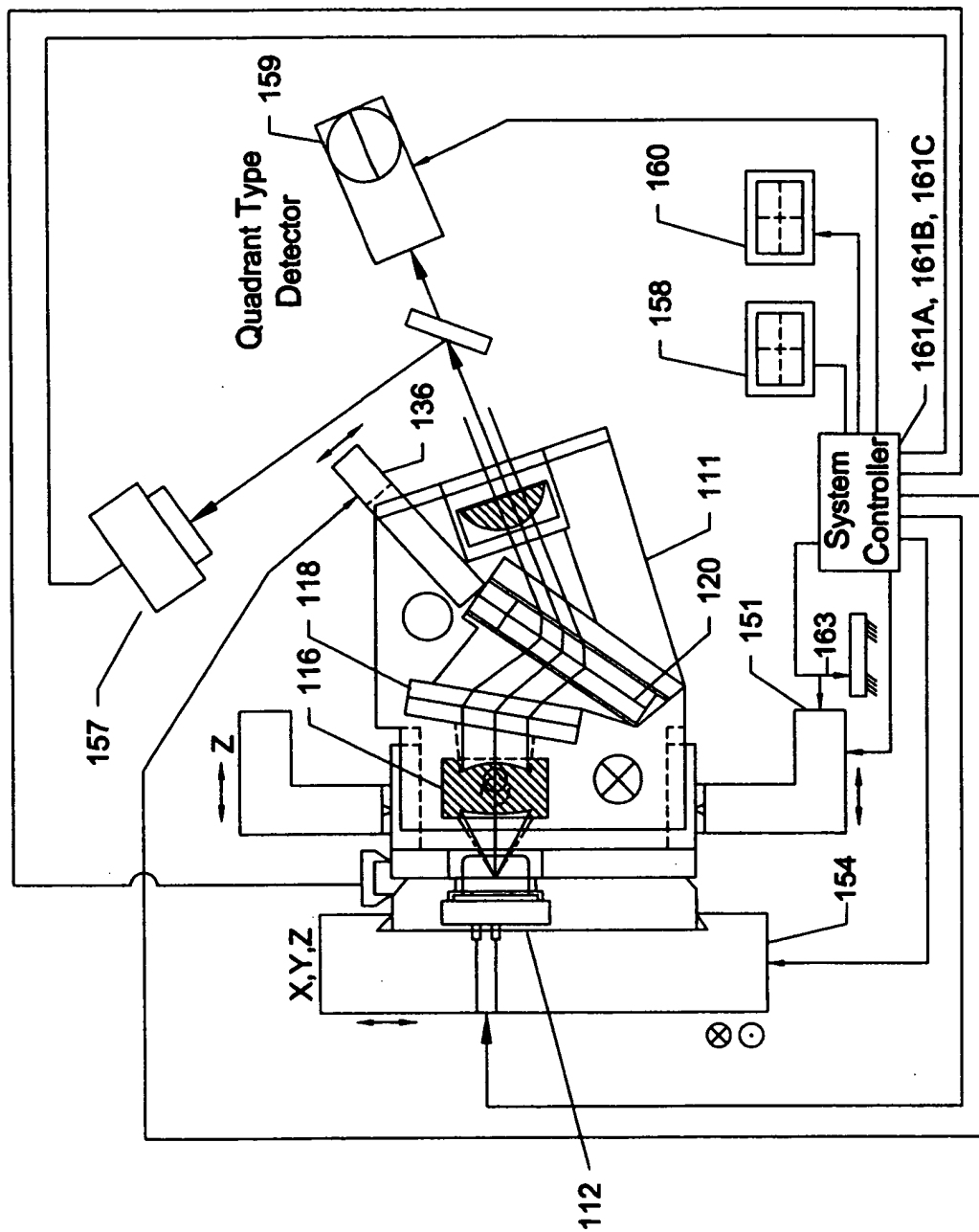


FIG. 15
(Case B)

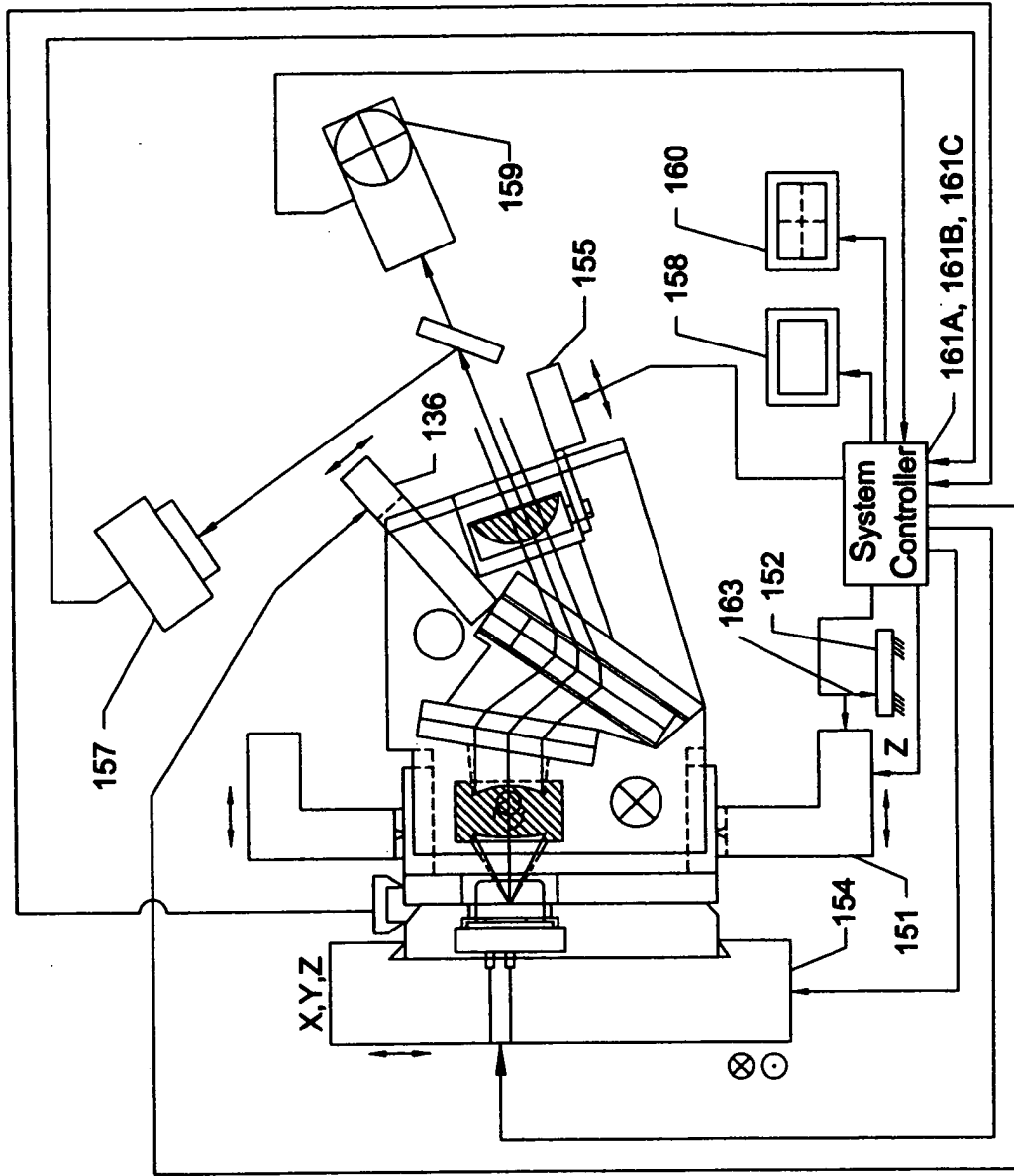


FIG. 16
(Case C)

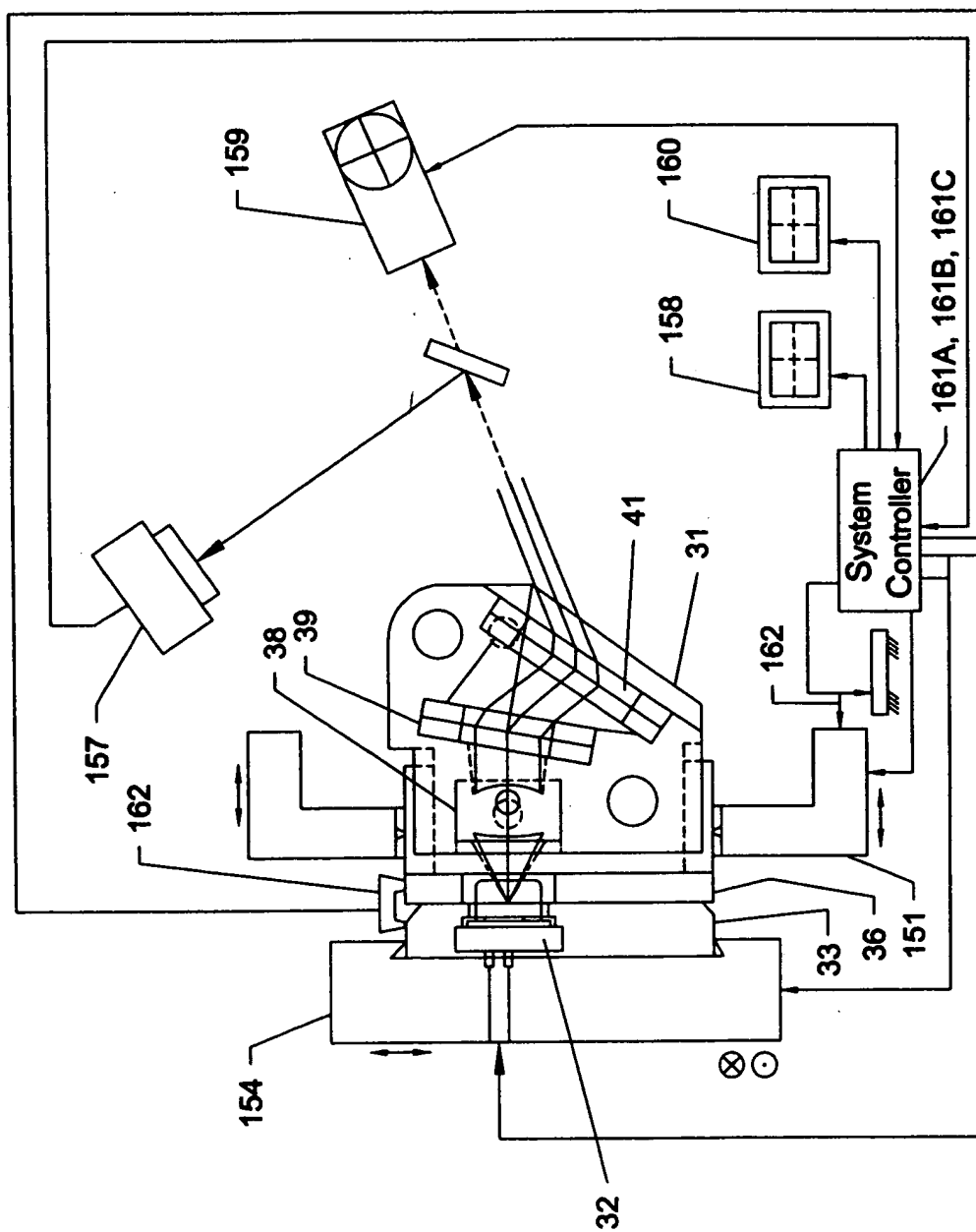


FIG. 17
(Case D)

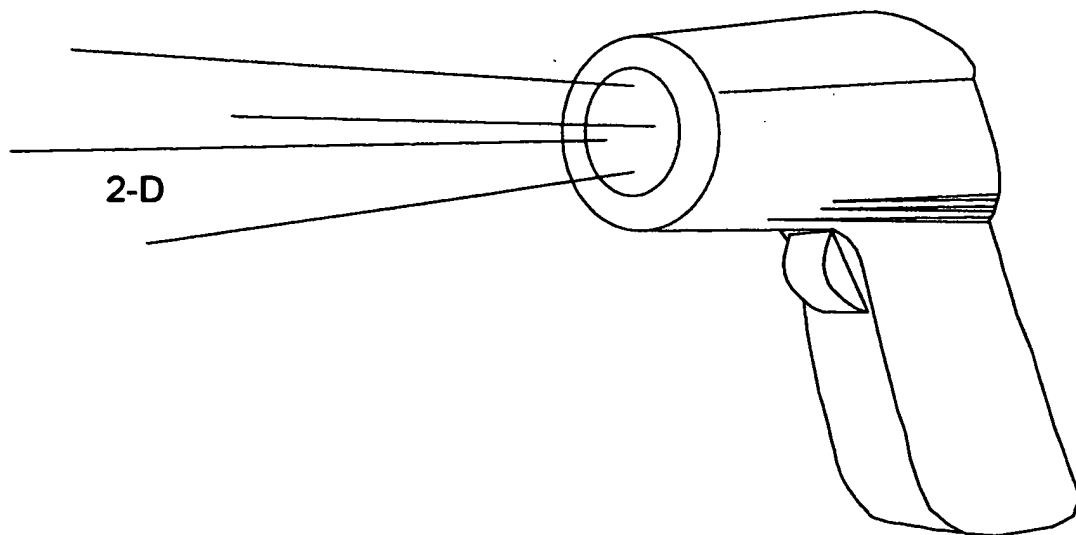


FIG. 18

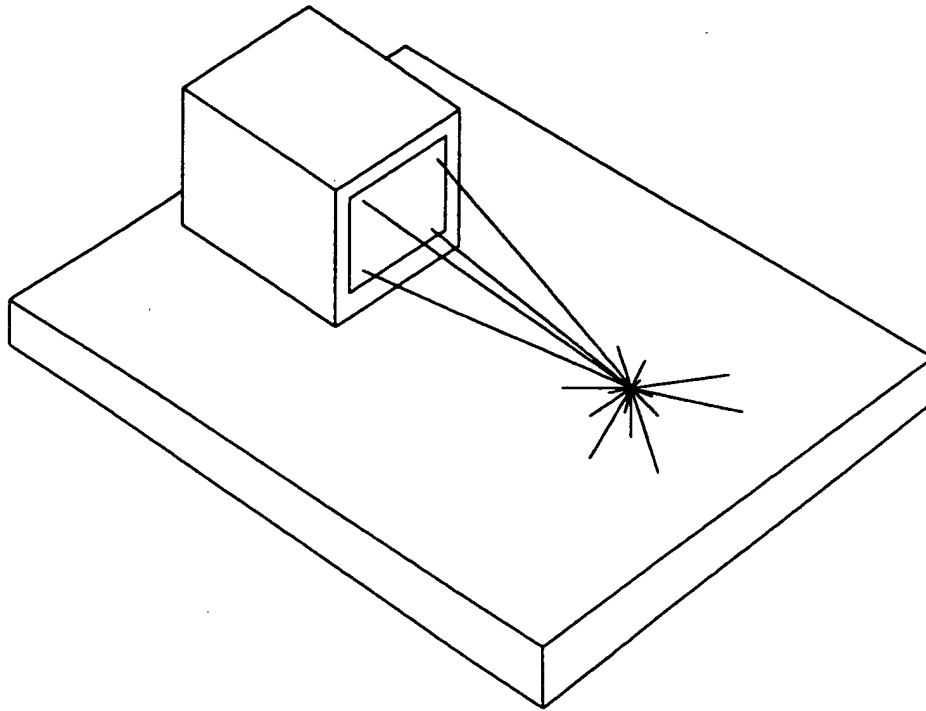


FIG. 19

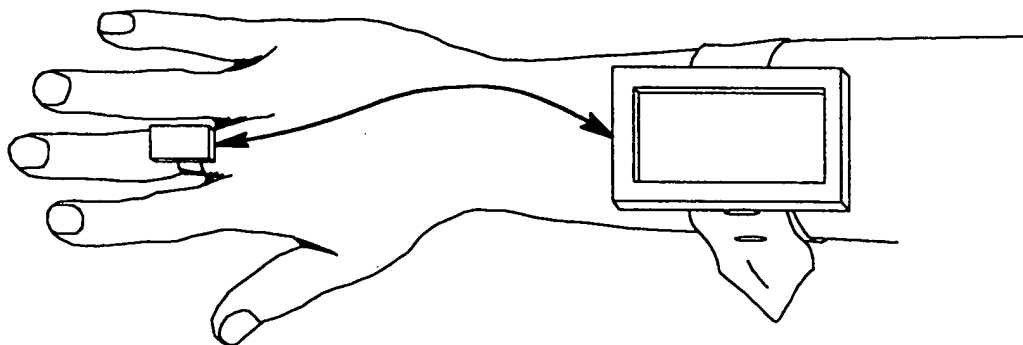


FIG. 20

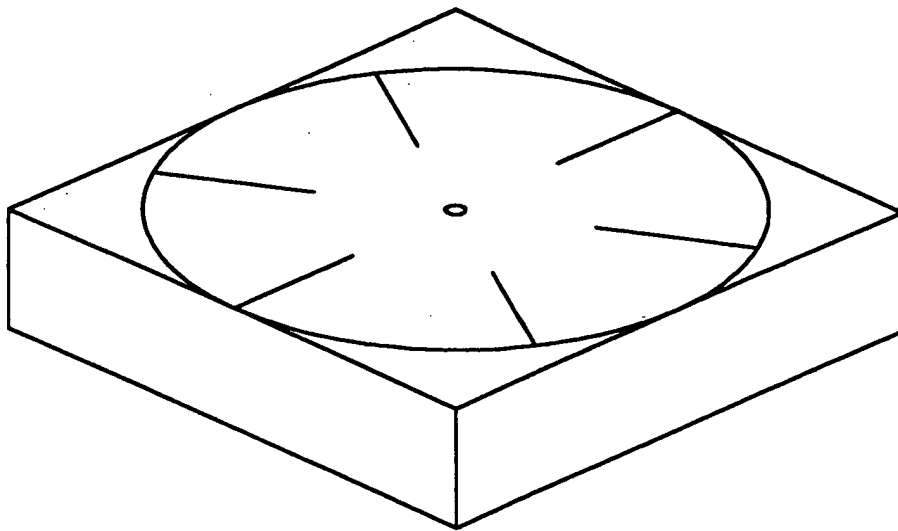


FIG. 21

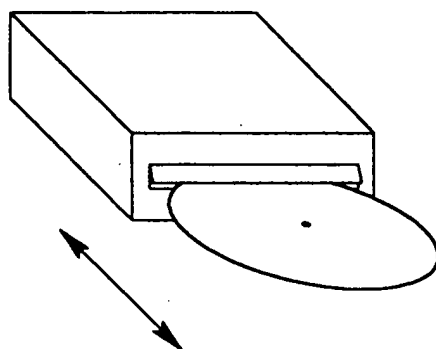


FIG. 22

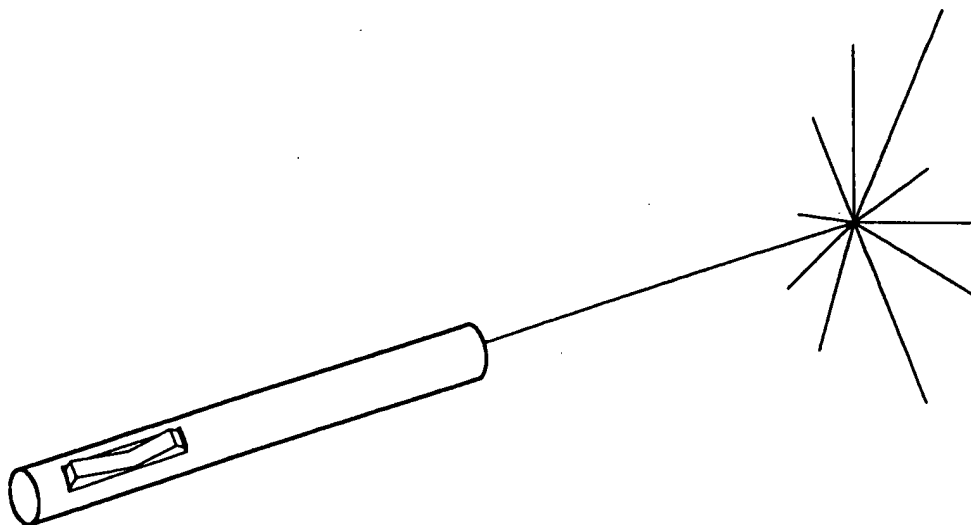


FIG. 23

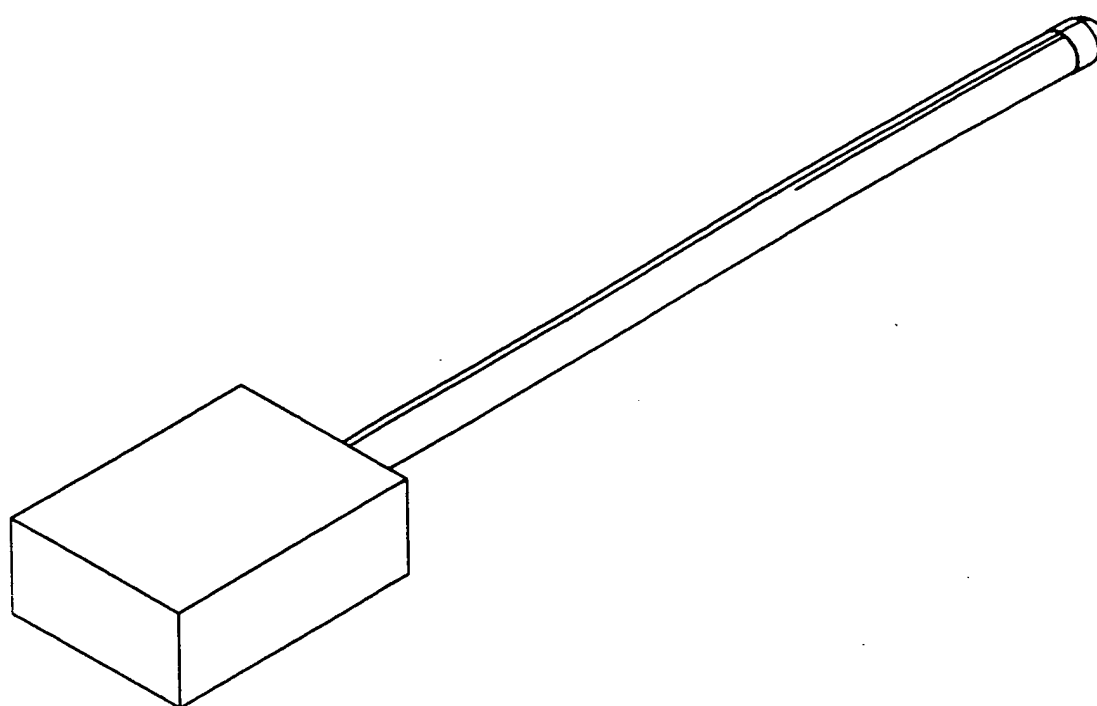


FIG. 24

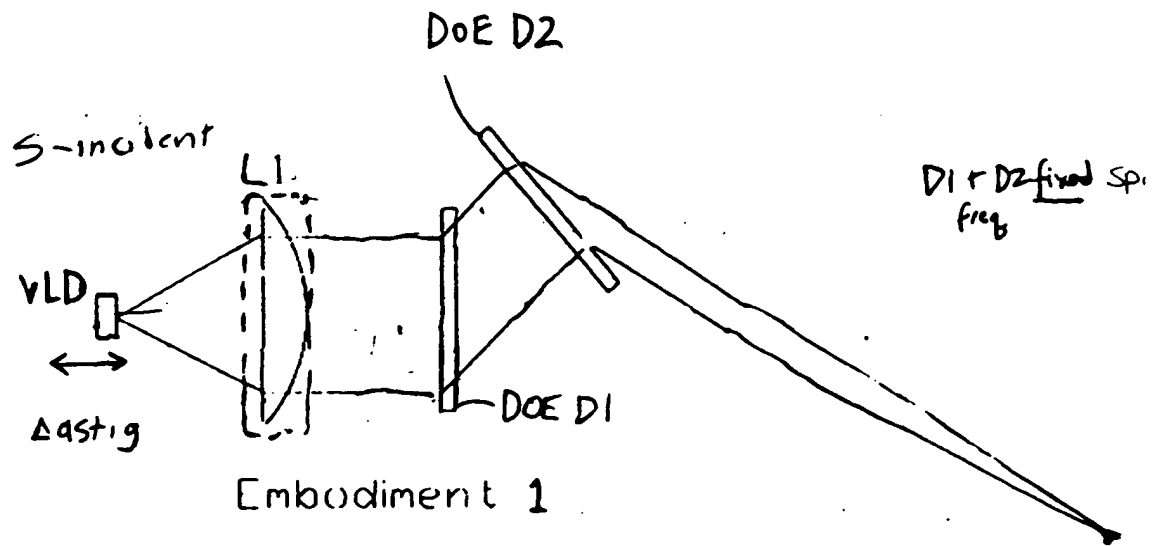


FIG 2A

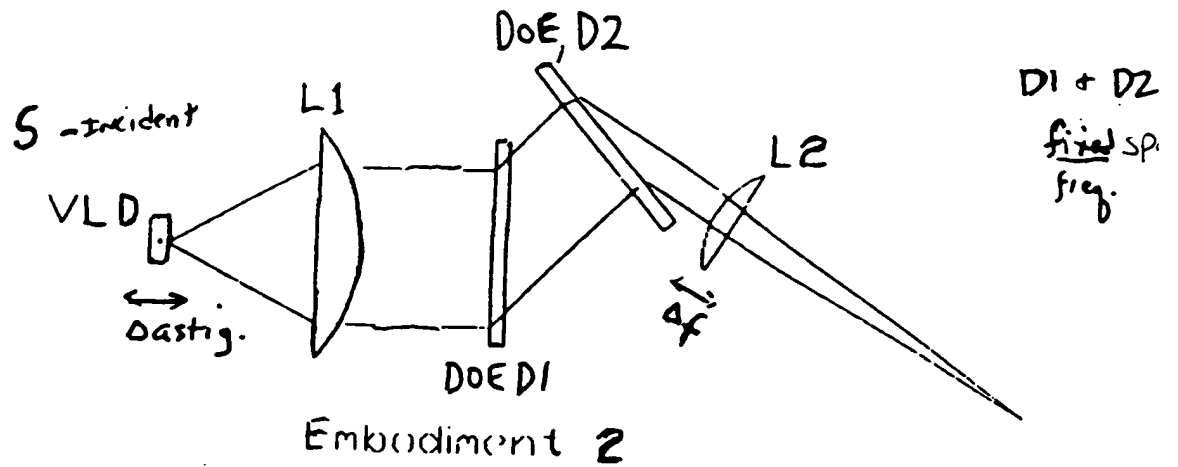


FIG. 2B

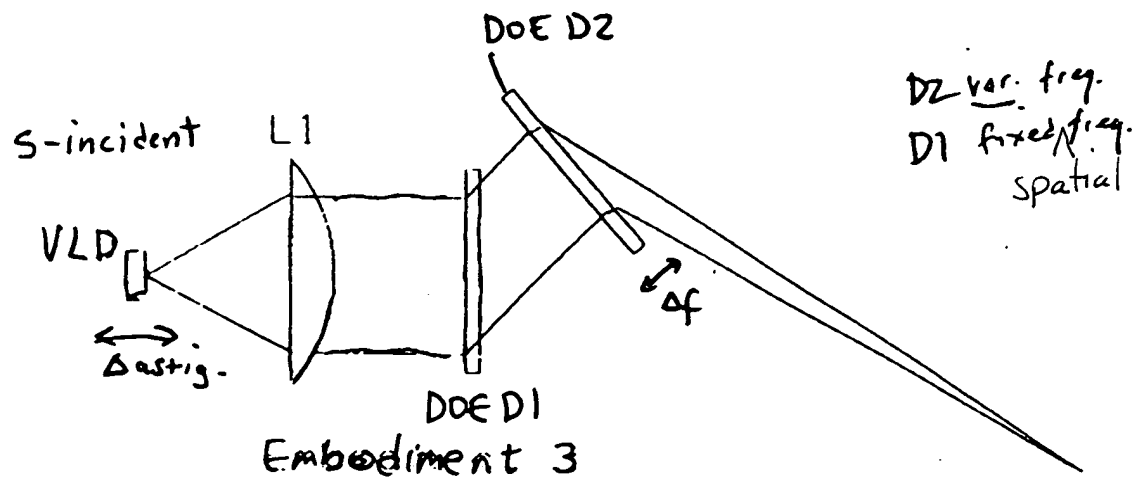


FIG. 2C

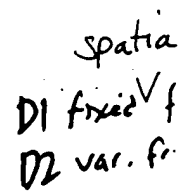


FIG. 2D

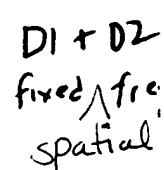
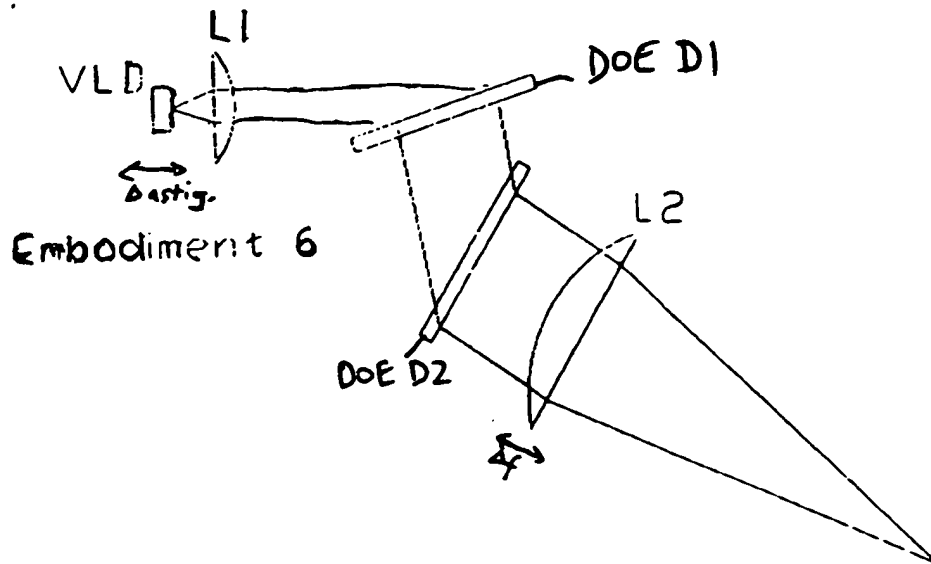


FIG. 2E

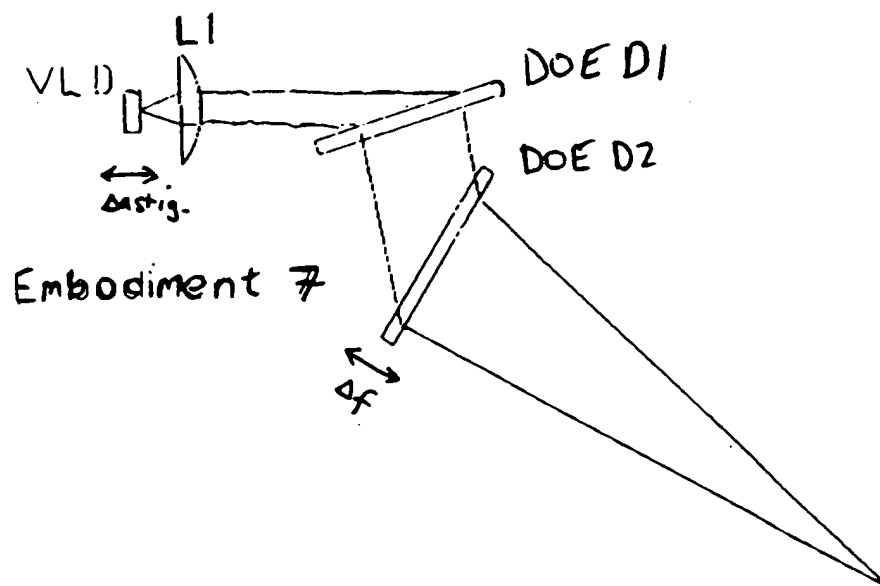
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D1 & D2
fixed sp
freq

FIG. 2f

~~Embodiment~~

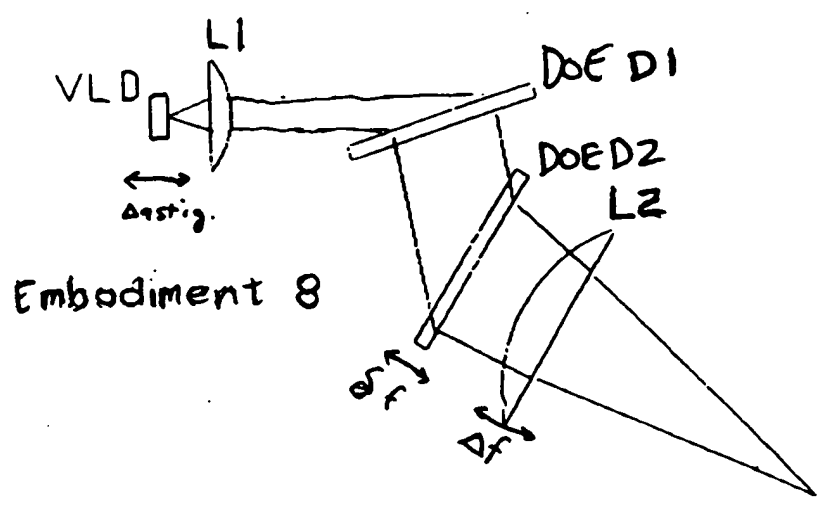


spatial
D1 fixed freq
D2 var. freq.

FIG. 2g

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P-incident

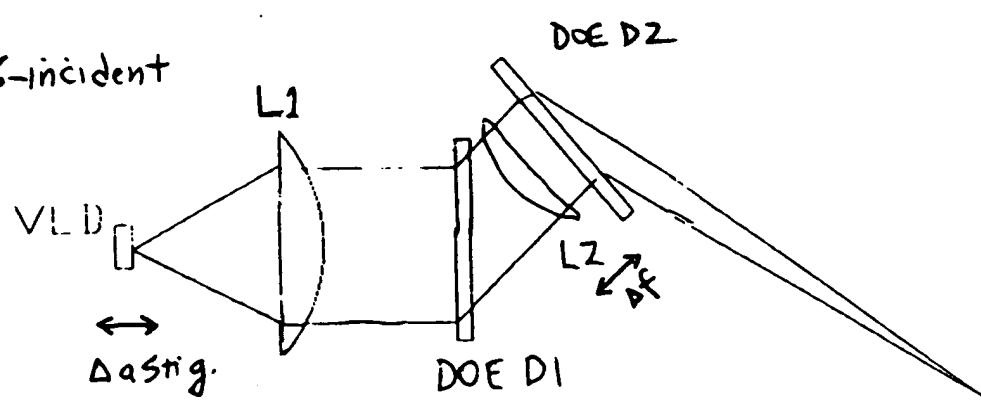


spatial
D1 fixed f_r
D2 var. f

Embodiment 8

FIG. 2H

S-incident



D1 + L
fixed
 f_{eq}

Embodiment 9

FIG. 2I

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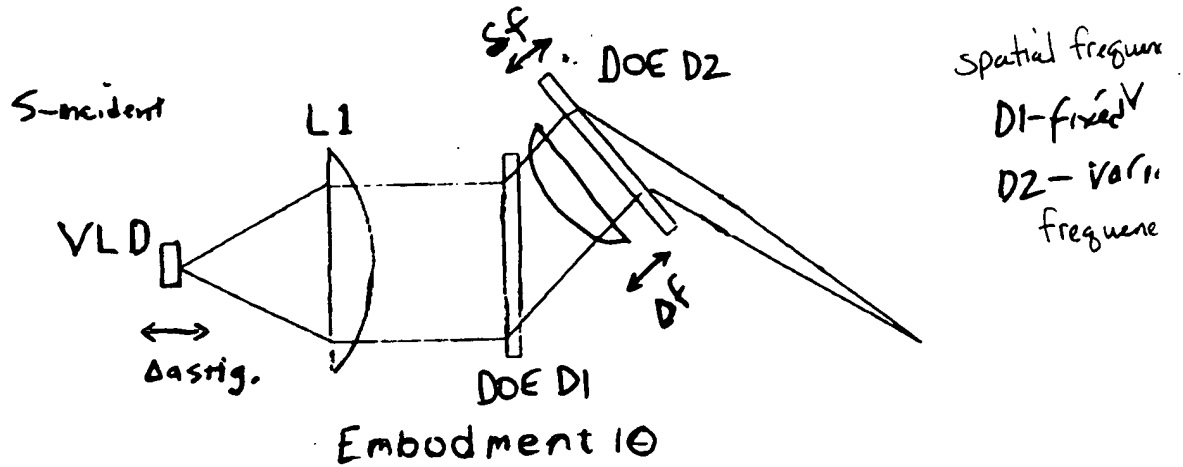


FIG. 2J

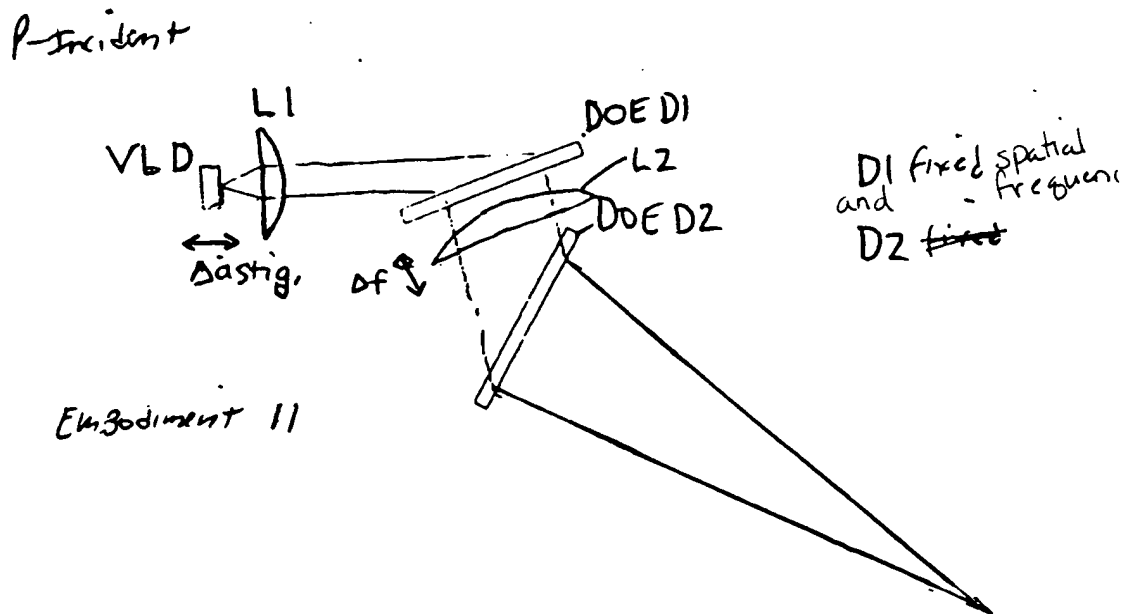
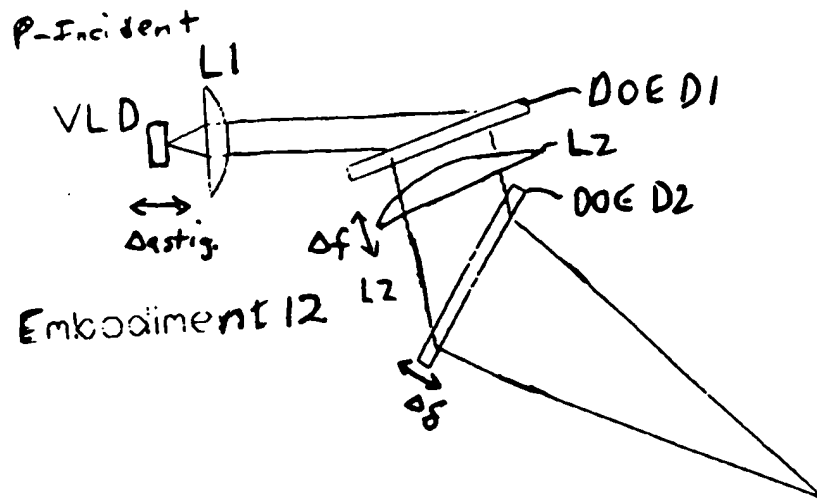


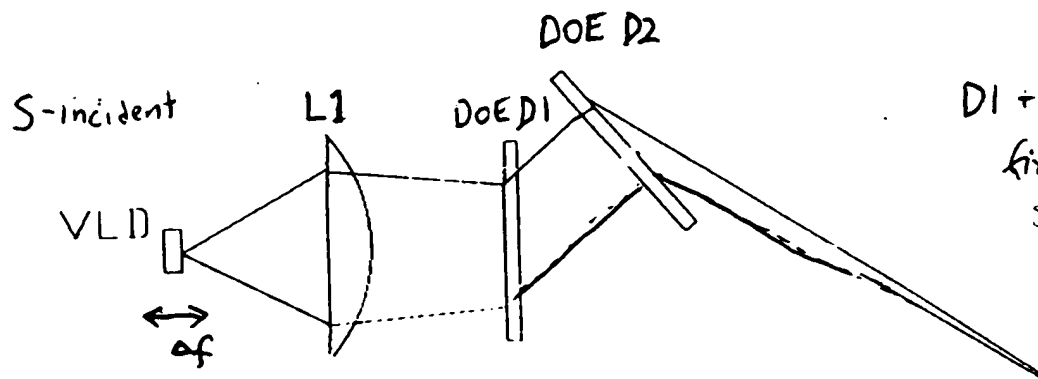
FIG. 2K

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spatial
D1 - fixed \checkmark freq
D2 - var. freq

FIG. 2L



D1 + D2
fixed freq.
spatial

Embodiment 13

FIG. 2M

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p-incident

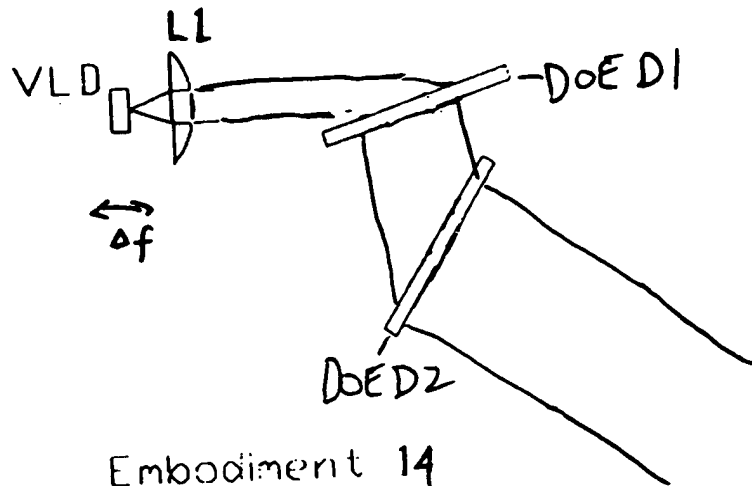


FIG. 2N